

HORTICULTURAL ABSTRACTS.

VOL. IX.

JUNE, 1939.

No. 2.

Initialled abstracts in the present number are by M. E. King and H. L. Pearse of the East Malling Research Station.

INDEX OF CONTENTS.

MISCELLANEOUS	Nos. 353-405
Growth promoting substances	353-369
Various	370-405
TREE FRUITS, DECIDUOUS	406-438
General	406-407
Varieties and breeding	408-411
Propagation	412-414
Rootstocks	415-420
Root growth	421-423
Pollination	424-427
Growth and nutrition	428-431
Manuring and cultural practices	432-438
SMALL FRUITS, VINES, NUTS	439-454
PLANT PROTECTION OF DECIDUOUS FRUITS	455-506
VEGETABLE GROWING, STIMULANTS	507-547
FLOWER GROWING	548-558
CITRUS AND SUB-TROPICALS	559-608
TROPICAL CROPS	609-653
STORAGE AND MARKETING	654-661
PACKING, PROCESSING AND PLANT PRODUCTS	662-681
NOTES ON BOOKS AND REPORTS	682-726

Horticultural Abstracts

Vol. IX

June, 1939

No. 2

MISCELLANEOUS.

*Growth promoting substances.**

353. WILSON, R. D. 577.15.04
Plant hormones.
J. Aust. Inst. agric. Sci., 1938, 4 : 185-91, bibl. 24.
 A brief account of such work on plant hormones as has advanced the knowledge of the subject.
354. DAVIS, W. 577.15.04
Plant hormones in agriculture.
Suppl. Science, 1938, Vol. 88, No. 2276, p. 7.
 Investigations of the Canadian National Research Council resulted in improvement in the manner of application of plant hormones. Instead of putting hormone chemicals in water and applying them in that way they are distributed in fine dust. It is easier to roll the seeds in the dust and stick the cuttings in fine powder. Since farmers already dust their seed with poison to kill fungus, the two operations may be combined. Demand is reducing the cost of hormones, naphthylacetic acid treatment costing only about a half cent per acre.
355. THIMANN, K. V. 577.15.04
Hormones and the analysis of growth.
Plant Physiol., 1938, 13 : 437-49.
 The author considers in some detail, from a physiological standpoint, the way in which it is probable or, at any rate, possible that hormones work in the plant to produce sometimes growth, and sometimes inhibition of growth or other phenomena.
356. ZIMMERMAN, P. W. AND HITCHCOCK, A. E. 577.15.04
Tropic responses of leafy plants induced by application of growth substances.
Contr. Boyce Thompson Inst., 1938, 9 : 299-328, bibl. 41.
 The plants used were tomato, *Cosmos sulphureus*, *Tagetes erecta*, *Helianthus debilis*, and tobacco, the chemicals α -naphthaleneacetic acid, β -indoleacetic acid and γ -indolebutyric acid. The experiments demonstrated the following facts. Induced tropisms are conditioned by the relative positions of the plant organs to gravity. Thus treated leaves of upright shoots showed epinasty whereas those of inverted shoots showed hyponasty. Results were similar whether the substances were applied to roots of intact growing plants, to the tops of plants with excised tips, or to the basal ends of excised shoots. Low concentrations accelerated negative and high concentrations positive geotropic responses. Growth substances applied to the soil or to the basal ends of excised shoots moved upwards inducing response at the tip. If the tip were removed and the cut end treated the substance moved downwards inducing response on its way. Treated shoots grew more than controls irrespective of the relative position of the shoot with reference to gravity. Experiments were also made and are reported on the effect on growth of laying plants on their sides and in other abnormal positions.

* See also 430.

357. ZIMMERMAN, P. W. AND HITCHCOCK, A. E. 577.15.04
The combined effect of light and gravity on the response of plants to growth substances.

Contr. Boyce Thompson Inst., 1938, 9 : 455-61.

The purpose of the authors in this paper is to extend the first report (*see* previous abstract) and to show how the combined effect of phototropism and geotropism condition the capacity of plants to respond to growth substances.

358. HITCHCOCK, A. E. AND ZIMMERMAN, P. W. 577.15.04
The use of green tissue test objects for determining the physiological activity of growth substances.

Contr. Boyce Thompson Inst., 1938, 9 : 463-518, bibl. 127.

Leaf cuttings of the tomato were used for testing the activity of substances which promote root formation. This proved to be a highly sensitive test object. The number of roots produced was influenced by the kind of growth substance used, the species or variety of cutting, the age of the cutting, the relative amount of leaf surface, and the atmospheric conditions (light, temperature and humidity) during treatment. Indole and naphthalene compounds were the most active root formers; simple acids (citric, acetic and sulphuric) were not active for root formation. Retreatment of cuttings, after the removal of the initially treated basal portion, induced the formation of more roots than in similar cuttings not retreated; but retreatment of intact cuttings from several weeks to several months after the initial treatment with growth substance indicate that there was no additive effect of the two treatments. Results with tomato leaf cuttings and stem cuttings of more than 100 species of commercially important plants confirmed the authors' previous conclusion that applied growth substance is transported upwards and downwards. Preliminary attempts to identify the structure of the applied growth substance (indolebutyric acid) by means of X-ray analysis indicated that this method offers new possibilities for determining the presence of, and the form in which, natural or applied growth substances occur in plants.

H.L.P.

359. SNOW, R. 577.15.04
On the upward inhibiting effect of auxin in shoots.

New Phytol., 1938, 37 : 173-85, bibl. 8.

The experiments described here were made with commercially obtained heteroauxin on pea seedlings. A comparative test was made on the effects of applying the paste above and below the internodes and the nature of the upward inhibiting effect (*see Ibidem*, 1936, 35 : 205) was considered. Le Fanu's conclusion that the upward inhibiting effect of heteroauxin paste applied below is quite different from any effect exerted by the same paste when applied above is confirmed.

360. TILFORD, P. E. 577.15.04 : 631.536
Effect of some synthetic growth substances on root development of transplanted trees.

Proc. 14th nat. Shade Tree Conference 1938, St. Louis, Mo., 1939, pp. 51-9.

The effect on new root production of treating the roots of young red oaks at transplanting with indoleacetic and indolebutyric acid in different ways and at different strengths varied considerably. Of the two substances indolebutyric acid was the more effective, and of the treatments soaking for 48 hours in a 40 p.p.m. solution proved best and wrapping the cut ends of the roots in sphagnum moss soaked in solutions of the same concentration next best. Five oaks were submitted to each treatment. The trees were treated and planted 30 April, 1937, and dug for inspection 27 July, 1938.

361. HOWARD, H. W. 577.15.04

Possible action of phytohormones as root determiners.

Ann. Bot., Lond., 1938, 2 : 933-42, bibl. 6.

The stems of decapitated kale plants were treated with paste containing indole-3-acetic acid. Adventitious shoots in addition to roots were produced. These shoots are produced at a later date than the roots or when the supply of hormone is removed. The production of a second batch of adventitious roots was observed when the adventitious shoots had grown for some time. Both adventitious roots and shoots are formed from meristems produced near the vascular bundles. Buds or parts of buds in the axils of the cotyledons were found to develop as roots when the hormone was applied to the stem at a higher level. It is suggested that the most satisfactory explanation of the results is that the hormone has two effects: first it promotes the formation of meristems and then has a root-determining effect on these meristems. The growth of the second batch of adventitious roots is explained as being due to the production of a hormone by the leafy shoots. It is also shown that an internal origin is not necessary for roots. [Author's summary.]

362. STOUGHTON, R. H. AND PLANT, W. 577.15.04

Regeneration of root cuttings as influenced by plant hormones.

Nature, 1938, 142 : 293-4, bibl. 2.

Trials were carried out at Reading to establish a relationship between the local concentration of growth substances within the tissues and the production of buds and roots. Root cuttings (thongs) of seakale (*Crambe maritima*), 7 cm. long, were used. The morphological apices were treated for 20 hours with a solution of α -naphthalene-acetic acid (0.02%). After 14 days roots had been produced both apically and basally. The length of the roots varied from 1-5 cm. No buds were produced at the apex. In order to induce production of basal and apical buds, approximately 1 mm. of tissue was removed from the base and apex of the thongs every 5 days for a period of 8 weeks, when about 25% of the thongs produced buds at both ends. Thongs that failed to produce buds basally were either still producing roots in this region or were merely callused. The decapitation treatment was continued on the latter material and after another 4 weeks most of the thongs had produced buds at the base with no activity at the apex. The quiescence of the apex is thought to have been due to both auxin depletion and carbohydrate exhaustion. Removal of buds from both ends of the thongs followed by total immersion of the latter in an 0.02% α -naphthalene-acetic acid solution resulted in the development of roots over the whole length. Roots and buds formed in anomalous positions showed normal subsequent growth.

363. ALEXANDER, T. R. 577.15.04 : 635.652 : 581.192

Carbohydrates of bean plants after treatment with indole-3-acetic acid.

Plant Physiol., 1938, 13 : 845-58, bibl. 10.

The author examined the changes in carbohydrate content which occurred in the stem ends of bean plants* after removal of tips and treatment with 2% indole-3-acetic acid in lanolin and resulted in the appearance of tumours and roots at the point of treatment. There was found to be a translocation of carbohydrates towards the point of treatment. There was a higher percentage of starch in the treated than in the control stems. Simple carbohydrates were condensed to complex polysaccharides at the point of application in the treated stems. The reasons for these changes are discussed.

364. HERBST, W. 577.15.04 : 635.64

Wuchsstoffe in der gärtnerischen Praxis. I. Heteroauxin in der Tomatenkultur. (Growth promoting substances in horticulture. I. The use of heteroauxin in tomato production.)

Gartenbauwiss., 1939, 12 : 520-9, bibl. 16.

The use of heteroauxin (β -indolylacetic acid) was not so successful that it can be recommended for encouraging the germination of tomato seed. Much better germinating results were obtained

* *Phaseolus vulgaris*, var. Dwarf Red Kidney.

from sowing the seed in the usual manner on garden compost. The growth of tomato plants raised from seed treated with heteroauxin was influenced by the treatment but such treatment showed no appreciable advantage in this respect over sowing on compost soil. On the other hand heteroauxin treatment of young tomato fruits resulted in earlier ripening and larger-sized fruits at harvest time. Furthermore, seedless tomato fruits may be obtained by the help of heteroauxin which induces parthenocarpic development in unfertilized ovules. This fact should prove useful.

365. MYERS, M. C., BOWDEN, R. A. AND HARDISTY, F. E. 577.15.04
Stimulation of kudzu cuttings.
Science, 1938, 88 : 167.

In Georgia commercial synthetic hormone products used at recommended dilutions for prescribed durations gave a higher percentage of strike in kudzu* cuttings than was obtained with untreated cuttings. The most noticeable effect was, however, the increase in size and number of roots per cutting. In a subsequent test potassium permanganate was tried (one ounce to eight gallons of water for 30 min.) and was found to be superior to any hormone product yet tested for kudzu, both as to percentage of rooting and size and number of roots developed.

366. GUTHRIE, J. D. 577.15.04 : 633.491
Effect of ethylene thiocyanohydrin, ethyl carbylamine, and indoleacetic acid on the sprouting of potato tubers.
Contr. Boyce Thompson Inst., 1938, 9 : 265-72, bibl. 13.

A substance believed to be ethylene thiocyanohydrin was effective in breaking the dormancy of potato tubers. Ethyl carbylamine also showed marked dormancy-breaking action. Neutralized indoleacetic acid inhibited the sprouting of pieces of non-dormant potato tubers when the bases of the pieces were soaked in solutions ranging from 25 to 100 mg. per 100 cc. for 1 to 7 days at 10° C. These treatments with neutralized indoleacetic acid also induced rooting at the cut surface of the pieces. Rooting at this part of potato tubers has not been observed before in this laboratory, nor have we found a report of such rooting in the literature. [Author's summary.]

367. BLOCH, R. 577.15.04
Anatomical changes in *Tradescantia fluminensis* Vell. after treatment with growth substances.
Contr. Boyce Thompson Inst., 1938, 9 : 439-54, bibl. 20.

The growth substance lanolin mixtures used were, in order of decreasing effect :—0.3 and 0.5% naphthalene acetic acid, 0.5 and 1.0% indolebutyric acid, 1.0% indoleacetic acid, and 0.5% indoleacetic acid, the last having no effect. The application of these to the intact stem of *Tradescantia fluminensis* induced responses and histological changes generally comparable to those reported for dicotyledons, though somewhat less vigorous. The anatomical effects of such treatment are described in some detail.

368. BONNER, J. AND ENGLISH, J. 577.15.04
A chemical and physiological study of traumatin, a plant wound hormone.
Plant Physiol., 1938, 13 : 331-48, bibl. 26.

The authors employed Wehnelt's method in which an immature bean pod is used for demonstrating wound hormone activity. In their tests size of the new growth rather than frequency of cell division is measured. The test was shown to be specific for this wound hormone. The name traumatin is proposed for the substance which possesses typical wound hormone activity and was isolated with the aid of the quantitative assay.

* *Pueraria hirsuta* Schneider.

369. PRATT, R. 577.15.04
Influence of indole-3-acetic acid on the respiration and growth of intact wheat seedlings.
Amer. J. Bot., 1938, 25 : 389-92, bibl. 9.
 THIMANN, K. AND LANE, R. H. 577.15.04
After-effects of the treatment of seed with auxin.
Amer. J. Bot., 1938, 25 : 535-43, bibl. 21.
 MICHENER, H. D. 577.15.04
The action of ethylene on plant growth.
Amer. J. Bot., 1938, 25 : 711-20, bibl. 31.
 SKOOG, F., BROYER, T. C. AND GROSSENBACHER, K. A. 577.15.04
Effects of auxin on rates, periodicity and osmotic relations in exudation.
Amer. J. Bot., 1938, 25 : 749-59, bibl. 37.
 CLARK, W. G. 577.15.04
Electrical polarity and auxin transport.
Plant Physiol., 1938, 13 : 529-52, bibl. 45.

Various.

370. THORNTON, N. C. 577.16 : 581.192
Extraction and determination of vitamin C in plant tissue.
Contr. Boyce Thompson Inst., 1938, 9 : 273-81.

The paper describes a modification of methods previously recommended for the extraction of vitamin C from plant tissues. The modified procedure is said to be accurate and considerably quicker.

371. REID, M. E. 612.014.44 : 577.16
The effect of light on the accumulation of ascorbic acid in young cowpea plants.
Amer. J. Bot., 1938, 25 : 701-11, bibl. 45.

The remarkable effect of light on the accumulation of ascorbic acid during germination and in the early stages of growth is demonstrated, the experimental material in this case being cowpea seedlings. From the results obtained here and elsewhere it is considered that fruits and vegetables grown under conditions of low light intensity would tend to have lower vitamin C values than those developed under conditions of greater illumination.

372. BONNER, J. 577.16 : 581.144.2
Thiamin (vitamin B) and the growth of roots : the relation of chemical structure to physiological activity.
Amer. J. Bot., 1938, 25 : 543-9, bibl. 17.

373. SIMONET, M. 631.53 : 577.15.04 : 547.944.6
 Sur l'obtention de plantes géantes et polyploïdes, après application de colchicine.* (The use of colchicine to get giant and polyploid plants.)
C.R. Acad. Agric. Fr., 1938, 24 : 846-50, bibl. 8.
 LEFÈVRE, J.
 L'obtention expérimentale de végétaux polyploïdes—observations sur son intérêt agricole. (Observations on the agricultural interest of experimental production of polyploids.)
Ibidem, pp. 944-55, bibl. 24.

Simonet deals with his results obtained by treating the seeds of radish and 2 flax varieties with aqueous solutions of colchicine by immersion for 2, 4 or 6 days in 0.1, 0.2 and 0.4% concentrations. He was successful in producing polyploid giant plants in a number of cases. Lefèvre discusses the probable reasons for results obtained and the use to agriculture of such work.

* With introduction (pp. 5) by Schribaux.

374. CROCKER, W. 58
Botany of the future.
Science, 1938, 88 : 387-94.

This address was given before the American Association for the Advancement of Science in the Conference on Science and Society, Ottawa, 28 June, 1938. Together with the literature citations it will be published in full later by the Association.

375. SHAMEL, A. D. AND POMEROY, G. S. 575.252 : 016
Bud mutation bibliography.
J. Hered., 1938, 29 : 198.

It is announced that the mimeographed supplementary bibliography of 185 titles referred to in the article Bud mutations of horticultural crops, by Shamel and Pomeroy, *J. Hered.*, 1936, 27 : 486-94, *H.A.*, 7 : 285, but not published there, is now made permanently available as Document 1087 of the American Documentation Institute, 2101 Constitution Avenue, Washington, D.C., at 33 cents for a microfilm or 1 dollar 50 cents for photo prints legible without optical aid.

376. JONES, W. W. 575.255
Chimaeras : a summary and some special aspects.
Bot. Rev., 1937, 3 : 545-62, bibl. 42.

The subject of chimaeras has already been reviewed in some detail both by the present author (*Plant chimaeras and graft hybrids*, Methuen, London, 1934) and by Chittenden, R. J., and Kreuhe and Weiss. The aim in the present paper is to summarize what has been learned about chimaeras and to discuss their significance as affecting particular biological problems. Types of chimaera, i.e. those in which one or more branches differ throughout genetically from the rest of the plant, sectorial chimaeras, periclinal chimaeras and mericlinal chimaeras are described. Consideration is given to the origin and recognition of chimaeras. Their importance to the study of developmental morphology is stressed and finally their possible economic importance is considered. In this last connexion it is noted that the periclinal form undoubtedly possesses potential value in relation to disease resistance, since the chances of infection of a susceptible variety of plant should, it is thought, be greatly lessened, if that variety could be obtained as a periclinal chimaera with a skin contributed by some immune variety. If the plant were one readily propagated vegetatively, the immune chimaeral form might well become commercially important.

377. CLARKE, S. H. 576.31
Fine structure of the plant cell wall.
Nature, 1938, 142 : 899-4, bibl. 15.

"The aim of the present account is not to offer a complete survey of the literature (the references quoted will lead indirectly to the more important contributions to the subject), but to give a fairly simple picture of the current conception of the different phases of cell wall structure." The writer does not attempt to give a complete picture, explaining that the details of certain size structures must still be largely supplied by inference and conjecture.

378. LA COUR, L. 576.3 : 578
Improvements in plant cytological technique.
Bot. Rev., 1937, 3 : 241-58, bibl. 65.

The author discusses recent improvement in the technique of the plant cytologist under the following headings:—Fixing techniques; fixing fluids; dehydration and infiltration; stains for chromosomes; pretreatment; illumination and projection.

379. GOODSPEED, T. H., AND UBER, F. M. 612.014.44 : 576.3
Radiation and plant cytogenetics.
Bot. Rev., 1939, 5 : 1-48, bibl. 326.

The interrelation of radiation and cell conditions is considered under the following headings :—Introduction and historical summary ; physical nature of biological effects of radiation ; types of material irradiated ; types of induced alteration ; cytogenetic consequences of chromosomal alterations.

380. MEYER, B. S. 576.34
The water relations of plant cells.
Bot. Rev., 1938, 4 : 531-47, bibl. 27.

The author deals with the subject under the following headings :—Osmosis and osmotic pressure, imbibition and imbibition pressure, osmotic relations of plant cells, dynamics of intercellular movement of water in plants, and water relations within individual cells.

381. CROCKER, W. 581.142 : 631.531.16
Life-span of seeds.
Bot. Rev., 1938, 4 : 235-74, bibl. 71.

Crocker follows Ewart's classification into 3 biological classes :—microbiotic, with a life-span of not more than 3 years ; mesobiotic, life-span 3-15 years ; and macrobiotic, with a life-span of from 15-100 years or more. The age degeneration of seeds is probably due to a gradual dislocation in the delicate chromosome apparatus of cells of the embryo. Hence the best storage conditions are those which best prevent such dislocations. The life-span of a seed is determined by genetic and environmental factors. Seeds which remain dormant thanks to impervious coats are specially well adapted for long vitality in the soil. Probably the optimum condition for storing all seeds which endure air drying or further desiccation is adequate drying followed by sealed storage in absence of oxygen at a low temperature. As an example the normal life-span of delphinium seed has been lengthened more than 9-fold by such storage. There seems little doubt that most farm and garden seeds, whose normal life-span appears to be 3-15 years, would enter the macrobiotic class given optimum storage conditions.

382. BARTON, L. V. 631.531
Experiments at Boyce Thompson Institute on germination and dormancy in seeds.
Sci. Hort., 1939, 7 : 186-93, bibl. 32.

The paper summarizes some results of investigations of the most suitable conditions for germinating various seeds. A great number offer no special problem, some will only germinate at low temperatures, others will only germinate at high temperatures if there has been pre-treatment at lower temperatures. Lettuce and the annual delphinium are examples. Legumes often suffer from delayed germination or totally fail because of their hard seed coats which prevent the absorption of water. These are successfully treated by various methods which abrade or soften the seed coat. Seeds with partially dormant embryos are often found in varieties requiring low temperature pre-treatment resulting in slow growing dwarfs ; peach, apple and hawthorn are examples. When grown experimentally at 62° F. from germination they remained dwarfs for from 6-18 months before starting to grow, but when exposed to a temperature of 41° F. for 2 months the secondary dormancy was overcome and vigorous growth followed removal to a higher temperature. Some varieties combine a hard seed coat with a dormant or partially dormant embryo. Seeds with hard coats often require low temperature pre-treatment after removal of the seed coat. A list of some of these is given. Epicotyl dormancy i.e. failure of the shoot to grow, although the root is produced at ordinary temperatures, is exhibited in peonies and high bush cranberries among others. This dormancy can be broken by exposing the germinated seed to low temperatures, 33°-50°F., for a while. These plants with epicotyl dormancy can be treated normally by sowing in spring or summer to permit the emergence of the radicle, while the cold in the succeeding winter can be relied on to break the epicotyl dormancy.

383. FLEMION, F. 581.142 : 631.531
A rapid method of determining the viability of dormant seeds.

Contr. Boyce Thompson Inst., 1938, 9 : 339-51, bibl. 70.

A new method is described whereby the viability of dormant seeds can be determined, without recourse to germination, in from 5 to 10 days, by excising the embryos and observing their behaviour on moist filter paper at a temperature of 21-23° C. Non-viable seeds deteriorate rapidly, while viable embryos show various types of development. Results thus obtained tally with ordinary germination tests.

384. GUSTAFSON, F. G. 612.014.44 : 581.14
Influence of the length of day on the dormancy of tree seedlings.
Plant Physiol., 1938, 13 : 655-8, bibl. 7.

Pinus resinosa seedlings, under indoor conditions, if not exposed to freezing during the winter, made either no growth or very little growth in the summer unless exposed to a photoperiod of about 16 hours.

385. GARNER, W. W. 612.014.44
Recent work on photoperiodism.
Bot. Rev., 1937, 3 : 259-75, bibl. 39.

Advance in the 16 years since the first paper by Garner and Allard is dealt with by Garner in the present review. After noting the now accepted classification of plants into long-day and short-day types and what this exactly means the author considers in turn the varietal differences in photoperiods in closely related varieties ; the effect of length of day on tuberization ; the incidence of photoperiodicity in woody plants ; the photoperiodic after-effects i.e. those which come into evidence when alternating periods of short-day and long-day illumination are given ; vernalization in its relation to day-length requirements ; artificial illumination and the intensity needed ; spectrum investigations on the photoperiodic effects of different regions of the visible spectrum ; and finally the vegetative versus reproductive development of plants as affected by photoperiod.

386. CRAFTS, A. S., AND BROYER, T. C. 581.144.2 : 581.192
Migration of salts and water into xylem of the roots of higher plants.
Amer. J. Bot., 1938, 25 : 529-35, bibl. 38.

The problem of salt migration in roots of higher plants as contrasted with accumulation by cells is posed, and a mechanism to explain solute migration, water movement, and root pressure is suggested. The various activities of the root are discussed, including oxygen supply, ion uptake, organic nutrient supply, water movement, and secondary movements of solutes. The relations of these factors to this mechanism are pointed out, and supporting evidence from the literature is cited. A mechanism depending upon an activity gradient, conditioned by environmental differences imposed upon the tissues by their very structure, seems best to explain observed salt migration in roots. Such a mechanism fits most of the data and is consistent with known root structure. [Authors' summary.]

387. HOFFER, G. N. 631.83 : 632.19
Potash in plant metabolism. Deficiency symptoms as indicators of the rôle of potassium.

Industr. Engng Chem. (Industrial edition), 1938, 30 : 885-9, bibl. 52.

In this paper the author refers to certain relevant investigations on the potash problem in order to throw light on the relation which apparently exists between potassium and some of the vital processes in plant metabolism and growth. Potassium does not apparently enter into any permanent organic combinations in the plant, though it is essential for the production of most of the compounds formed. This points to an intimate relation of potassium to protoplasmic functioning in comparison with some of the other elements. Potassium ions affect

the colloidal cytoplasm and regulate, in a measure, the degree of swelling. This may explain the protective action of potassium in increasing plant resistance to drought and to frost. Potassium ions are absorbed in larger quantities than any other mineral and are absorbed at maximum rate throughout the plant's life. Hence their deficiency becomes very important. The importance of potassium in the initial growth stages is known to exist but its exact relation to respiration, transpiration and growth processes still needs careful examination. The precise connexion of potassium deficiency with leaf scorch in fruit trees still needs elucidation. Its effect on metabolism in vegetables is realized and deficiency symptoms in vegetables take many forms. Potassium functions in producing a balance in the quantities of the chlorophyll components. It affects carbohydrate formation. Its function in the processes of plant growth is closely related to the effects of light, and plants with higher potassium content are able to utilize the energy of sunlight to a greater degree. The very large number of different effects noted by the author indicates that the element has an important function in many of the vital physiological processes and suggests the necessity for intensive biochemical and physiological research into the causes of the phenomena presented by potash-starved plants.

388. VON BRONSART, H. 631.811.9
 Die Spurenelemente und ihre Bedeutung für Pflanze, Tier und Mensch. (**The minor elements and their importance for plants, animals and human beings.**)
Phosphorsäure, Vol. 6 and 7, 1937-1938, pp. 465-9, bibl. 4.

The minor elements concerned are Si, Mn, Cu, Ni, Co, Al, B, Mo, Cr, Pb, Sn, Zn, Ti, V, Cd, Ag, Sr, I and F. Some of the major elements are also considered. The topics dealt with are (1) the rôle of certain minor elements in the plant; (2) the effect of deficiencies in certain elements on certain plants; (3) the medical aspect of the presence of certain elements in plant foods for both man and beast; (4) soil exhaustion due to withdrawal of certain nutrients and non-replacement; (5) adequate manuring.

389. McMURTREY, J. E., JR. 632.19 : 631.8
Distinctive plant symptoms caused by deficiency of any one of the chemical elements essential for normal development.
Bot. Rev., 1938, 4 : 183-203, bibl. 131.

The author remarks on the more noticeable symptoms which become apparent in different plants and signify the deficiency of certain mineral elements from the soil or other medium in which they are growing. Among those of special horticultural interest are the following:—cork in apples, browning in cauliflower, cracked stem in celery due to *boron* deficiency; yellowing of tomato tops, deterioration in leaves of peas, breakdown of leaves in terminal bud of tobacco due to *calcium* deficiency; exanthema of citrus cured and onion growth improved by the addition of *copper* when there was previously a deficiency; chlorosis of a large range of plants due to *iron* deficiency; characteristic chlorosis of tobacco due to lack of *magnesium*; a typical *manganese* chlorosis in tomatoes; yellowing and water deficiency in leaves of fruit trees and other plants due to *nitrogen* deficiency; restricted growth and development of purplish tint in apple leaves due to *phosphorus* deficiency, mottling or chlorosis, generally of the older leaves, coupled with necrosis in most plants as the result of *potassium* deficiency; yellows of tea due to *sulphur* deficiency. A key is given to differentiate the deficiency effects of all the above elements in tobacco plants grown in culture solutions.

390. HOAGLAND, D. R. 581.13 : 631.8
Some aspects of the salt nutrition of higher plants.
Bot. Rev., 1937, 3 : 307-34, bibl. 118.

This review is prepared primarily for botanists without a specialized interest in plant nutrition. Its special interest to the horticultural investigator lies in the fact that it is concerned especially with advances in the problems of mineral nutrition which have been made possible by the use of sand and water cultures.

391. NIGHTINGALE, G. T. 581.13 : 631.84
The nitrogen nutrition of green plants.
Bot. Rev., 1937, **3** : 85-174, bibl. 305.

This very able review of the whole subject of nitrogen nutrition of green plants should be invaluable to all working on plant nutritional problems. The subject, which is copiously documented, is dealt with under the following headings :—Synthesis and hydrolysis of storage proteins ; synthesis and hydrolysis of leaf proteins ; metabolism of stems ; the new synthesis of organic nitrogen from nitrogenous nutrients ; storage and assimilation of nitrate ; external factors influencing ammonium and nitrate nutrition ; internal factors influencing ammonium and nitrate nutrition ; comparative metabolism of ammonium and nitrate-supplied plants ; nitrate nutrition ; absorption of organic compounds of nitrogen ; growth in relation to available nitrate ; effects of temperature on nitrate nutrition ; effects of day length on nitrate nutrition.

392. MOYER, L. S. 678.11 : 581.135.1
Recent advances in the physiology of latex.
Bot. Rev., 1937, **3** : 522-44, bibl. 103.

Among genera and species containing latex are the following :—*Hevea*, *Palaquium*, *Papaver*, *Achras*, *Lactaria*, *Russula*, *Acer platanoides*, *Asclepias*, *Lactuca*, *Taraxacum*, *Ficus*. The literature on the production of latex by the plant, which is scattered through many different journals, is sifted from a physiological standpoint. Its findings are considered under the following heads :—Occurrence and composition ; formation ; movement in intact latex vessel ; utilization by the plant ; flow after tapping ; specificity of particles.

393. MULLARD, S. R., AND STOUGHTON, R. H. 663.61 : 581.084.1 : 635.64 + 635.944
Preliminary trials in growing horticultural crops in nutrient solutions.
Sci. Hort., 1939, **7** : 174-9, bibl. 6.

Tomato plants grown in liquid tank culture gave yields as good and gladioli gave results superior to those of comparable plants grown under normal soil cultivation in otherwise similar surroundings. The results did not produce the huge yields reported from California, but the light and carbon dioxide supply doubtless acted as limiting factors. Sand and gravel or cinder culture are two other methods which with some crops seem even more promising of economic results than liquid culture. The advantages of soilless cultivation are accuracy of control of nutritional conditions, better control of water supply and of root temperature, avoidance of soil-borne pests and reduction of labour. There are some interesting illustrations.

394. TEMPLEMAN, W. G., AND WATSON, S. J. 663.61 : 581.084.1
Growing plants without soil by nutrient solution methods.
J. Minist. Agric., Lond., 1938, **45** : 771-81, bibl. 6.

Experiments are in progress at Jealott's Hill Research Station to obtain some definite data on crops grown in nutrient solutions for commercial purposes. American methods are first described in some detail, under the headings—solution culture—sand culture—sub-irrigation—drip culture. At Jealott's Hill several points with regard to the solution were found to need close attention namely iron supply, aeration of the solution, concentration and changing of the solution, temperature control. With tomatoes in the English experiments no proof was obtained that the yields were as good as those under the best soil conditions, though it is recognized that these methods under commercial conditions are still in their infancy and much remains to be learned. Experiments are now proceeding with other crops.

395. VARADARAJA IYENGAR, A. V. 581.192 : 546.711
Estimation of manganese in plants.
Indian J. agric. Sci., 1938, **8** : 819-28, bibl. 10.

An examination has been made of the applicability of lead peroxide for the oxidation of manganese to permanganate with a view to improving this method for adoption in routine analysis.

It was found that nitric acid concentration, time of heating and, to some extent, the amount of lead peroxide used, were factors which influenced the rate of oxidation of manganese. An easy and rapid method has been described. The stability of the tint in presence of iron salts was tested and found to be maintained through the addition of phosphoric acid. The improved lead peroxide method was found to compare very favourably with the periodate technique both with pure salts and with different plant parts studied. [Author's summary.]

396. GREGORY, F. G. 581.11
A convenient method for attaching potometers and an example of its use in measuring the uptake of water by leaves during recovery from wilting.
Ann. Bot., Lond., 1938, 2 : 253-5.

A method whereby, in transpiration experiments, quick connexion can be made between plant stems or petioles and potometers is here described and illustrated.

397. SINGH, B. N., AND ANANTHA RAO, N. K. 612.014.44
A photo-electric photometer for chemical analysis.
Plant Physiol., 1938, 13 : 419-25, bibl. 4.

398. LAWRENCE, W. J. C., PRICE, J. R., ROBINSON, G. M.,
 AND ROBINSON, R. 581.175.11
A survey of anthocyanins. V.
Biochem. J., 1938, 32 : 1661-7, bibl. 5.
 PRICE, J. R., AND STURGESE, V. C.
A survey of anthocyanins. VI.
Ibidem, pp. 1658-60, bibl. 7.

In these two articles, which are part of a series, details are given of the anthocyanins present in a large number of plants.

399. HEATH, O. V. S. 581.12
An experimental investigation of the mechanism of stomatal movement, with some preliminary observations upon the response of the guard cells to "shock".
New Phytol., 1938, 37 : 385-95, bibl. 23.

400. WIESMANN, R., AND JENNY, J. 536.58
Vollautomatischer Elektro-Brückenthermostat "Wädenswil". (The Wädenswil automatic electric bridge thermostat.)
 Reprinted from *Landw. Jb. Schweiz.*, 1938, pp. 913-32, bibl. 12.

An apparatus has been designed and is described here, which permits simultaneous ecologic investigations to be made on the behaviour of insects at varying temperatures.

401. SPURWAY, C. H., AND WILDON, C. E. 631.811.91 : 631.544
Water conditioning for greenhouses.
Circ. Bull. Mich. agric. Exp. Sta., 166, 1938, pp. 10.

This is a progress report on water conditioning for greenhouses, lawns and gardens, in order to maintain suitable pH values in the soil. The installation and operation of an apparatus to condition hard water by neutralizing the carbonate hardness with phosphoric acid is described. The effect of the conditioned water on the pH values and phosphorus content of four different soil mixtures is discussed. The results are tabulated.

402. SKILLMAN, E. 631.67
Overhead irrigation.
J. Minist. Agric., Lond., 1939, 46, 171-5.

A brief account of the methods used and plant required in the installation of overhead irrigation for vegetable crops. Disadvantages of any irrigation system are high cost, a possible change in soil texture and the rapid decomposition of organic manures. Advantages are considerable

independence in regard to the weather, ability to plan crop production and labour distribution in confidence and an improvement in the quality of produce.

403. LOEHWING, W. F. 581.144.2
Root interactions of plants.
Bot. Rev., 1937, 3 : 195-239, bibl. 422.

In this amply documented review the author considers his vast field under the following headings : —toxic secretions ; iron-toxic excretions ; interplanted legumes ; amino-acid secretion ; nodule bacteria and the C/N ratio ; interaction with non-symbiotic bacteria ; mycorrhiza, growth-promoting substances. He also evolves definite conclusions from his review.

404. WYLLIE, J. 634/5-1.16
(Report of) Department of Economics.
J. S.-E. agric. Coll. Wye, 1938, No. 41, pp. 30-2.

This brief report of the work of the Economics Department of the College is interesting to horticulturists chiefly as giving a note on a separate report entitled " Financial results on the college horticultural holding, 1931/32 to 1934/35," (No. XXIV, pp. 26, 1936, 2s.). To those interested in the economics of horticulture practised as part of a general farm this report XXIV can be warmly recommended.

A note is also given on the college's investigations into the costs of producing canning peas.

405. RAWITSCHER, F. 581.184.1
Geotropism in plants.
Bot. Rev., 1937, 3 : 175-94, bibl. 67.
HUNT, I. V. 544/5 : 632.954
New methods for the detection of minute quantities of chlorates (in plant tissues and soils).
J. S.-E. agric. Coll. Wye, 1938, No. 42, pp. 119-25, bibl. 3.
HEYROVSKÝ, J., AND KLUMPAR, J. 016 : 535.511
Bibliography of publications dealing with polarographic methods.
Coll. Trav. chim. Tchécosl., 1938, 10 : 153-73, bibl. 363.

TREE FRUITS, DECIDUOUS.

General.

406. RIETSEMA, I. 634.1/7
Vierde beschrijvende rassenlijst voor fruit, 1938-1939. (The 4th descriptive list of fruit varieties.)
Published by den Nederlandschen algemeenen Keuringsdienst (N.A.K.), 1939, pp. 86.

This list of fruits grown in Holland includes almonds, apples, apricots, bilberries, blackberries, cherries, cranberries, currants, figs, filberts, gooseberries, medlars, mulberries, peaches, pears, plums, quinces, raspberries, strawberries, vine-grapes, walnuts and whortleberries.

407. DAVIS, M. B., AND BLAIR, D. S. 634.1/7
Some recent recommendations in fruit growing.
Seventy-fifth annu. Rep. Nova Scotia Fruit Growers' Ass. (Jubilee edition) for 1938, pp. 68-72.

The questions dealt with include the following :—*Tree building*. As regards treatment of the young tree under Canadian conditions the following is recommended :—Allow the young tree

to grow in the nursery without pruning or disbudding until the end of the first year when it may be desirable to cut back to one or two buds. At the end of one year a whip will be available, which if left for another year will feather out and produce many laterals. Of these only those below 14-16 in. from the ground should be removed. A large leaf area will thus be provided and this will develop a stout trunk and good root, so that at the end of the second year a sturdy tree with plenty of laterals will be ready for transplanting. Laterals should be left for a year after transplanting and only then should be removed as required. *Pruning.* Pruning in a young tree should not be excessive and should be sufficient only to shape it properly and develop a mechanically strong tree. In a bearing tree its object should be first to maintain ample new growth on which new spurs may form and second to improve fruit quality. *Topworking.* Frame-working is the method recommended. It may be noted that in Tasmania petroleum jelly is used to cover the wounds so made, in England hot grafting wax, and in Canada a wax similar to that used for ordinary topworking.

Varieties and breeding.

408. JAPAN TIMES. 634.1/8
Japanese fruits.

Japan Times and Mail, Tokyo, 5 November, 1938, pp. 58.

A number of interesting and well illustrated articles in English on production of fruits, vegetables, nuts, vines and lily bulbs in Japan. Some of the articles deal with related topics such as fruit export, canning and processing, quarantine of export fruits and vegetables, and horticultural experiments. Some of the cultivation methods are interesting as being used only in Japan or even in one locality only, as, for example, the forcing of strawberries in the open air on specially constructed stone walls. Again, grafting the watermelon on the white-flowered gourd has been found to prevent wilt disease (*Fusarium nivium* E. F. Smith), to which this fruit is particularly liable.

409. UPSHALL, W. H., AND DICKSON, G. H. 634.11
McIntosh as a filler variety.

Reprinted from *Canad. Hort. Home Mag.*, February, 1939, pp. 2.

Although coming into bearing after some other varieties, McIntosh trees outyield most of them in the early years and at the same time produce a large bearing area for future crops. These characteristics, together with a high value for its fruit, make McIntosh a good filler variety, particularly in the semi-permanent position in the centre of the square made by four permanent trees.

410. TIKHONOVA, A. S. 634.11
The seedlings of certain Mitchurin apple varieties. [Russian.]
Sci. Fruitgrowing, Mitchurinsk, 1938, No. 6, pp. 24-30.

A number of natural Anis Kitaika and Saffron-Kitaika seedlings have been selected which have a high degree of hardiness and produce good crops of fine quality fruits.

411. KUZNETSOV, P. V. 634.13-1.523-1.541.11
***Pirus salicifolia* as initial material for selection work.** [Russian.]
Sci. Fruitgrowing, Mitchurinsk, 1938, No. 6, pp. 31-3.

On account of its resistance to drought and disease and its adaptability to adverse soil and temperature conditions, *P. salicifolia* promises well for breeding purposes. A number of hybrids obtained from the cross between this species and fine European varieties are at present being studied in Cuba (U.S.S.R.) and Azerbaijan. When used as a rootstock *P. salicifolia* produces good unions with most European and local pears.

Propagation.

412. ANON. 631.541.44 : 634.1/2

Unusual method of grafting.

Orchard. N.Z., 1938, 11 : 291-2.

A method of bridge grafting is described and illustrated. It is employed here not, as is usual, to bridge diseased portions of stems but as a method of working a tree over to another variety. The bridge grafts are inserted along the leader branches of bush trees which have been slightly headed back and denuded of side shoots. The scion may be any length and is not restricted to 6 or 8 inches. Photographs are given showing the grafts crowded with apples seventeen months after grafting.

413. GARNER, R. J. 634.1/2-1.541.44.

Regrafting fruit trees by framework methods.*

J. Minist. Agric., Lond., 1939, 46 : 176-87.

The methods of frameworking fruit trees in such a manner that the grafts are held by the tree itself without the aid of tying or nailing are described. The types of graft used are either cleft grafts or rind grafts ; the cleft graft variations are stub and side grafts, the rind graft methods are inverted L bark graft and the awl graft. The various operations are described in detail with the aid of line drawings.

414. GARNER, R. J., AND WALKER, W. F. 634.1/2-1.541.44

Practical methods of frameworking fruit trees.*

Sci. Hort., 1939, 7 : 33-44.

Four methods of frameworking are described, consisting of two methods of cleft grafting, the stub graft and the side graft including the oblique side graft, and two methods of rind grafting, the bark and awl grafts. The processes are clearly illustrated by line drawings.

Rootstocks.

415. HATTON, R. G. 634.1/2-1.541.11

Rootstock work at East Malling.

Sci. Hort., 1939, 7 : 7-16.

An outline of the rootstock work of East Malling and of the results so far obtained. Rootstocks are necessary because (a) it is usually difficult to raise temperate deciduous tree fruits on their own roots on a commercial scale, (b) trees on their own roots are generally inferior in some respect to grafted trees, (c) the rootstock enables control to be exercised over the size of tree and cropping in relation, for instance, to soil type or planting distances. *Apples*. No. IX, the most dwarfing stock, is suitable with proper care for a wide range of soils although its anchorage is poor ; there is no reduction in keeping quality of the fruits if picked at the right time, bearing in mind that it produces a rather earlier maturity. Nos. IV and VII are truly semi-dwarf, vigorous growers in youth and highly productive. 80-90% of the 5 million apple trees planted in Denmark are on No. IV. It blows over easily. No. VII is highly susceptible to crown gall. Nos. I and II, regarded as suitable for the bush trees of commerce, appear to be influenced by scion variety and growth conditions, e.g. Cox's Orange Pippin is semi-dwarf on I and vigorous on II, the reverse being the case with Lane's Prince Albert and Worcester. Under dry conditions in England and Canada trees on I are less vigorous than those on II. The only very vigorous stocks retained are Nos. XVI and XII ; XVI brings the tree into bearing earlier and gives higher yields than XII. It is now the standardized vigorous rootstock of Germany (frequently under the name of Ketziner Ideal). Since no stock is as yet ideal, research

* See also Garner and Walker. The frameworking of fruit trees. *Occas. Pap. Imperial Bureau of Horticulture and Plantation Crops* 5, 1938. 1s.

is still continuing. *Pears*. Quince stocks A, B, and C have been selected as the most reliable stocks for general commercial varieties. D is incompatible with too many varieties to be safe. B induces slightly better cropping and slightly greater vigour than A, C is dwarfing and good with shy cropping varieties, is susceptible to leaf spot in the nursery and sometimes makes a weak union. Three wilding quince varieties from Russia are under trial at East Malling. Seedling pears used as stocks have shown great differences morphologically, botanically and in compatibility. Selection work is in progress with a view to finding a stock to make medium bush trees for pear varieties that are incompatible with quince. Double working trials on quince rootstock have shown the pears Fertility, Hessle and Pitmaston Duchess to be successful intermediates with the majority of scion varieties. *Plums*. Myrobolan B produces the most vigorous trees and is compatible with most but not all varieties. Common Plum is markedly dwarfing, imparts resistance to silver leaf, especially with Victoria, but is incompatible with many other important varieties including Czar. Brussels is fairly dwarfing; except with Victoria it seems to give poor growth and crops, and it suckers freely. Common Mussel also has a dwarfing effect and suckers freely. Pershore (Yellow Egg) and Marianna give large crops and a moderate-sized tree. St. Julien and Damas seedlings show great variability in vigour and compatibility. No single rootstock of any of those mentioned is compatible with all scion varieties. Research is directed to finding stocks which will produce small or medium trees of good performance. *Peaches*. Hale's Early and Peregrine have been used at East Malling as scion varieties. Brompton, Common Mussel and two selections of Damas C and St. Julien A have proved satisfactory stocks. Peach and almond stocks have not been tested. *Cherries*. Selected seedlings from *Prunus Avium*, *Prunus Mahaleb* and *Prunus Cerasus* have been propagated vegetatively and have been under trial from 12-16 years. Morello on Mahaleb has proved rather short-lived; Morello on *P. Cerasus* has made small trees. A trial of sweet cherries on 14 selected Mazzards shows differences in growth and yield. Future work includes trials of clones of *P. Cerasus* with a view to forming medium or bush trees for sweet cherry varieties. *Incompatibility*. Recent studies at East Malling indicate that incompatibility arises from mechanical weakness and obstruction at the union and that differences in cambial activity, rate of callus growth, date of leaf expansion and relative rate of growth of stock and scion are all involved. *Rootstock influence*. The progress made in investigations into the source of rootstock influence is briefly noted and some account is given of the methods used.

416. BUDAGOVSKY, V. I.

634.11-1.541.11

Fundamental types of dwarfing rootstocks. [Russian.]

Fruits and Vegetables, Moscow, 1938, No. 12, pp. 47-50.

Among the descriptions of various apple stocks is that of the Crimean rootstock, a new type discovered by Margolin in Crimean nurseries. The stock forms naturally a pyramid-shaped bush. Its shoots are vigorous, firm and straight and of a pale brown colour with admixture of green. The pubescence on the internodes is dense. The stocks have few lenticels, which are small and of light yellow colour. The buds are medium-sized, densely covered with hairs and attached loosely to the shoots. The leaves are medium to large being oval and pointed at the ends. The blade of the leaf is thin and meagre and of a lustreless green. The large double-toothed leaf edges, the teeth being markedly pointed, are bent upwards. The very definite leaf-edge character is characteristic of Crimean stocks. The under side of all leaves is very hairy, while on the upper side only young leaves are pubescent. The leaf-stalk is some 2 cm. long, firm, of a pale green colour and covered thickly with hairs. Stipules are large and are lancet-shaped. Cuttings have a fair rooting capacity.

417. GOULD, H. P.

634.1/2-1.541.11

Dwarf fruits.

Leaflet, U.S. Dep. Agric. 178, 1939, pp. 8.

This leaflet contains directions for amateurs on growing dwarf fruit trees.

418. GRUBB, N. H. 634.1/2-1.541.11
The influence of the intermediate in double worked apple trees. Nursery trials of the "stem-builder" process at East Malling.

J. Pomol., 1939, 17 : 1-19, bibl. 4.

The claim made by nurserymen on the mainland of Europe that standard trees on seedling stocks double-worked on stems of certain varieties known as stem builders* give stouter stems, a larger proportion of saleable trees and larger heads is partially confirmed by investigations made on apple trees at East Malling between 1931 and 1937. The implication of this theory that rootstock influence on vigour is thereby reduced was examined—using different intermediates—by means of trees on seedling rootstocks and by a comparison of trees on a dwarfing and a vigorous vegetative stock. Of the two scion varieties used Early Victoria appeared to show intermediate influence clearly in the reduction of rootstock influence, while Newton Wonder gave indefinite results. There are indications suggesting that the stem-builder intermediates influenced both the biennial habit in Early Victoria on the dwarfing rootstock IX and the set of fruit of both varieties on IX and of Early Victoria on XII also.

419. GRUBB, N. H. 631.541.11 : 634.11 + 634.13
The influence of intermediate stem-pieces in double-worked apple and pear trees.

Sci. Hort., 1939, 7 : 17-23.

Trials of double-working with apples and pears have been carried out at East Malling. With apples the intermediate influences vigour and cropping and probably time of ripening and colour. With pears the object was to find the best intermediate for working with incompatible varieties on quince roots. The influences found were more or less similar to those in apples. In both cases by double-working in one year the indirect influence of the intermediate, which arises from the effect of its yearling growth on the root system, can be eliminated. The value of the continental custom of using a stem builder intermediate is discussed. In experiments stem builder intermediates did not appear to produce great differences in vigour as for instance between trees on No. IX and trees on XII. Some of the effects obtained with particular combinations are given.

420. ROGERS, W. S., BEAKBANE, A. B., AND FIELD, C. P. 634.11-1.541.11 : 581.144.2
The influence of "stem-builder" intermediates on apple root systems.
J. Pomol., 1939, 17 : 20-6, bibl. 2.

1. The conformation and relative size of the root systems of twenty-four double-worked apple trees, excavated in detail, are illustrated and discussed. The trees were Early Victoria on rootstocks Nos. IX and XII with 5 ft. intermediate stem-pieces of Normanischer Ciderapfel and Early Victoria. The introduction of the "stem-builder" intermediate, Normanischer Ciderapfel, was found to have reduced the difference in size due to rootstock by invigorating the trees on No. IX. The morphological characteristics of the rootstocks were not influenced by the "stem-builder" intermediate. 2. Observations on the main roots of 480 double-worked apple trees are presented. The series comprised Early Victoria and Newton Wonder each re-worked on 5 ft. intermediate stems of the same variety and on Noir de Vitry, Normanischer Ciderapfel and Gelber Trier'scher Weinapfel, on rootstocks No. IX, No. XII and a collection of seedlings. None of the intermediates materially altered the morphological characteristics of the rootstocks Nos. IX and XII, nor did they eliminate variations among the seedling rootstocks. 3. "Root-weights" consisting of the central part of the root system with the stock stem attached, were obtained for the 480 trees described above. The results are tabulated and stem:root ratios presented. The "root-weights" showed that the difference in vigour of the root systems normally found between the dwarfing No. IX and the vigorous No. XII

* Such as Noir de Vitry, Normanischer Ciderapfel and Gelber Trier'scher Weinapfel.

was not eliminated, though it was somewhat modified by the introduction of the long "stem-builder" intermediates. Trees of Newton Wonder were found to have a higher stem : root ratio than those of Early Victoria. Little difference in stem : root ratio was found between trees worked with different intermediates. [Authors' summary.]

*Root growth.**

421. ROGERS, W. S. 581.144.2 : 634.1/2
Root studies. VII. A survey of the literature on root growth, with special reference to hardy fruit plants.
J. Pomol., 1939, **17** : 67-84, bibl. 118.

This survey forms the prelude to a future paper in which the author's observations on growing apple roots made by means of root observation trenches in the field will be described. In the present paper he summarizes the salient points of 118 of the more important papers on root investigational work selected from some 1,100 such papers.

422. BOYNTON, D., DE VILLIERS, J., AND 634.11-1.433 : 581.144.2
 REUTHER, W.
Are there different critical oxygen concentrations for the different phases of root activity ?
Science, 1938, **88** : 569-70, bibl. 3.

Studies in the field indicate that apple tree roots larger than 1 mm. in diameter are able to subsist in soil atmospheres containing less than 0.1% to 3% oxygen for considerable periods of time when the tree as a whole is in active growth. Controlled greenhouse experiments with apple seedlings suggest that when the oxygen in the soil is maintained at 3% the roots are at a "subsistence level" with respect to oxygen, i.e. they continue to live but grow slowly if at all. At oxygen pressures below 1% they seem actually to lose weight. It appears from analyses of soil gases in boxes containing newly planted apple trees, kept under controlled conditions, that a high oxygen level is necessary for initiation of new roots from an existing root system. In analyses made by the authors at the Geneva Agricultural Experiment Station a soil atmosphere containing about 12% oxygen reduced the size of the root systems and tops considerably. The greenhouse study with apple seedlings showed that normal growth of existing root tips did not occur at oxygen concentrations below 10%. The ash content of apple seedlings grown at different oxygen pressures decreased uniformly as the oxygen percentage was decreased below 15%. Since the dry weight of the root tissue was less at oxygen concentrations below 10% it is thought to be likely that absorption and accumulation were inhibited at such pressures. This coincides with the apparent upper critical concentration, and may mean that maximum accumulation occurs at the upper critical concentration of oxygen.

423. HORSFALL, F., JR., AND VINSON, C. G. 634.11 : 581.144
Apical dominance in shoots and proximal dominance in roots as related to structural framework of the apple.
Res. Bull. Mo. agric. Exp. Sta. **293**, 1938, pp. 23, bibl. 8.

Disbudding and treating with aqueous solutions of thiourea retarded the growth of the distal buds on one-year-old apple trees, so that the upper branches were not dominant in the first year. A reversal of apical dominance was found in some cases when four-year-old Delicious trees were cut back. Several conditions were found which were associated with the reappearance of apical dominance in cut-back trees. When several shoots were allowed to grow, lateral buds failed to grow. Want of water and light reduction to 380 foot-candles also favoured the inhibition of laterals.

* See also 403.

Pollination.

424. MICKLEM, T. 634.11 : 581.162.3

Pollination studies with the White Winter Pearmain apple.

Fmg S. Afr., 1938, 13 : 343-4, 361, bibl. 1.

A series of experiments to discover the reason for the constant malformation of White Winter Pearmain apples in the Langkloos district, S. Africa, produced the following results. Red Delicious, Commerce, Granny Smith, Rokewood Wemmershoek and Winter Banana gave excellent results as cross pollinizers for this usually self-sterile variety. Trees on good soil gave a higher percentage set when hand-pollinated than trees on poor soil treated with the same pollen. The trouble on poor soil seems to be due to the formation of many flowers with abnormal pistils. Trees on good soil also developed more seed and more seeded carpels than trees on poor soil under otherwise similar conditions. It is suggested that in established Pearmain orchards at least the third tree in every third row should be top-worked to a suitable cross-pollinizer.

425. RUDLOFF, C. F., AND WUNDRIG, G. 634.13 : 581.145

Zur Physiologie des Fruchtlens bei den Obstgehölzen. I. Die Aufblühfolge bei einigen Birnensorten. (**Flowering physiology of fruiting in fruit trees.**)

I. The succession of flowering in certain pear varieties.)

Gartenbauwiss., 1939, 12 : 530-54, bibl. 6.

1. The individual blooms of pear inflorescences are arranged in a 3/8 position, the blooms being as frequently inserted clockwise in the inflorescence axis as anti-clockwise. 2. The number of flowers is variable for each individual inflorescence of a variety or varieties, but a certain number of flowers generally occurs and is more or less characteristic of a variety or a varietal group. 3. As regards the succession in flowering the blooms within an inflorescence obey a certain rule. Besides this the order in flowering is a varietal characteristic which is genetically fixed. 4. The pears studied could be divided into three groups according to their character of order of flowering within the inflorescence. 5. A closer relationship between the order of flowering and the morphological structure of the inflorescences could not be established. 6. Certain relationships exist between the "upward stream of the sap" and the succession in flowering, which indicates that the rhythm of flowering order of the blooms is determined by nutritional-physiological factors. [Authors' summary.]

426. CRANE, M. B., AND BROWN, A. G. 634.22 : 581.162.3

Incompatibility and sterility in the gage and dessert plums.

J. Pomol., 1939, 17 : 51-66, bibl. 8.

The last detailed account of the work at Merton on plum pollination was published in 1925 (*J. Genet.*, 15 : 301). Similar experiments have continued and in the present paper an account is given of investigations of the gage group and other dessert varieties and results of self- and cross-pollination experiments are described and tabulated. They show that the gage and dessert plums "may be classified as follows:—(1) self-incompatible, (2) partially self-incompatible, (3) self-compatible varieties. Among the wholly and partially self-incompatible varieties cross-incompatibility occurs, both complete and in degree. Sometimes it is reciprocally expressed, but it may occur in one direction of crossing only, the reciprocal pollination yielding a full crop of fruit. In plums the frequency of cross-incompatibility is lower, and its behaviour more complex than in the sweet cherries. It is concluded that this is attributable to the hexaploid chromosome constitution of the plums. In the greengage group varieties occur which are very similar in their morphological characters and also in the incompatibility reactions. It is suggested that they are seedlings from parents recessive for several characters, or possibly that they may have originated as bud-sports. Degrees of generational sterility occur and are expressed by aborted pollen and imperfectly developed or non-viable seeds. Since self- and cross-incompatibility are of frequent occurrence in plums, it is necessary to interplant suitable varieties so that provision is made for effective pollination. Varieties in the same incompatible group, and varieties whose flowering times do not coincide, or fail to overlap appreciably, should not be planted together." [From authors' summary.]

427. STAEHELIN, M. 634.1/2 : 581.162.3 : 631.55
 Observations sur la fécondation et la fructification des arbres fruitiers. (**Fruit tree pollination and fruiting.**)
Bull. Soc. vaud. Sci. nat., 1938, 60 : 177-92.

It has been shown that in Valais the Franc-Roseau apple only produces satisfactory yields in districts where it is grown among diploid varieties such as Calville Blanche, Champagne Reinette, Reine des Reinettes, and Baumann Reinette. Low yields are usually obtained from orchards where Franc-Roseau and Canada apples are grown exclusively, the latter being a triploid variety and having a poor pollen incapable of fertilizing Franc-Roseau. The usually poor yields of Beurré Giffard pears along the border of Lake Geneva are explained by the exceptionally early flowering of this variety, making cross-pollination impossible.

Growth and nutrition.

428. ZHUCHKOV, N. G. 634.11 : 581.145.2
Two fundamental stages in the differentiation of fruit buds on one-year-old apple wood. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 12, pp. 25-9.

A new ringing method has been developed by which certain apple varieties in the Crimea and Mitchurinsk were induced to fruit at an appreciably earlier stage than usual. A circular cut is made through the bark and a portion of wood, the depth of the cut (2-5mm.) depending on the thickness of the stem or branch to be ringed. The operation is preferably made after the termination of the growing period, i.e. in June or July. The wound is callused about a fortnight later. No harm was done to trees ringed in this way as often as 3-4 times during the same year at fortnightly intervals. The efficiency of the method is explained by the fact that the eyes on the stem and branches pass through two periods required for the differentiation of fruit buds, namely the period of increased supply of minerals and the period of increased supply of organic nutrients.

429. LOBANOV, G. A. 634.11-1.55
Biennial bearing in apple trees. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 12, pp. 29-33.

Experiments at the Udarnik Farm and Dorokhov Garden of the Mitchurin Institute indicate that regular yearly yields of apples can be obtained by (i) planting such annually bearing varieties as Saffron Pippin and Slavyanka (both Mitchurin varieties) and (ii) by appropriate thinning. As the result of experimental data the author recommends the removal of approximately 66% of the fruit buds early in the spring of the year. Further trials will include the study of soil and manurial practices as affecting thinning results.

430. BENNETT, J. P., AND SKOOG, F. 577.15.04 : 634.1/2
Preliminary experiments on the relation of growth-promoting substances to the rest period in fruit trees.
Plant Physiol., 1938, 13 : 219-25, bibl. 5.

The experiments described here were made on dormant buds of pear, apple, peach and cherry. They confirmed the fact that low temperature, either in the field or in cold storage is essential for normal breaking of dormancy. The low temperature causes the accumulation in the buds of a precursor of auxin, which later appears. It was also shown that the rest period can be broken by the injection of certain growth-promoting substances. Those with which varying, but definite, success was achieved included tryptophane, β -indoleacetic acid and a series of extractions of autolysed brewers' and bakers' yeasts.

431. DONEN, I. 634.22 : 581.192
The nitrogen metabolism of the Kelsey plum.
Biochem. J., 1938, 32 : 366-75, bibl. 17.

Two different sets of Kelsey plum trees were used for the collection of sample plums throughout

the growth of the plum from petal fall to maturity. Analyses showed that : " There are three stages in the nitrogen metabolism of the plum. The first stage is greatly affected by the growth of the stone : the protein-/non-protein-N ratio falls very rapidly from 1.8 to 0.6 during this period, ammonia-N accumulates in the fleshy tissue of the plum up to 14% of the total N content, and the percentage of amino-N is diminished, presumably by migration into the stone. The second stage is marked by a rapid rise in both amino- and amide-N whilst ammonia-N falls to its lowest level. It is suggested that ammonia- and amide-N are interrelated. During the last stage of maturation the amide-N content of the plum remains constant. It is pointed out that the nitrogenous changes that take place in the plum during its second and third stages of maturation also occur in the apple, but only when the latter is very ' young '. In mature apples the nitrogen metabolism tends towards increasing protein synthesis ; in mature plums the tendency is towards increasing accumulation of non-protein-nitrogen."

Manuring and cultural practices.

432. ROACH, W. A. 581.111 : 634.1/2-2.19

Plant injection as a physiological method.

Ann. Bot., Lond., 1939, 3 : 155-226, bibl. 162.

This article differs little from that published as *Technical Communication No. 10* of the Imperial Bureau of Horticulture and Plantation Crops.* Not quite so much detail is given in the *Annals of Botany* article on the technique used and for that the reader is referred to the technical communication. The author first deals with the subject historically, then describes his own work and finally discusses the possible applications of the method for the practical fruit grower.

433. LEVY, B. F. G. 581.111 : 634.1/2-2.19

Plant injection for the diagnosis of mineral deficiencies.*

Sci. Hort., 1939, 7 : 50-9, reprinted *A.R. E.Malling Res. Stat.*, 1938, A22, 1939, pp. 235-43.

An illustrated account is given of the method and technique of injection of plants with various substances for the diagnosis of mineral deficiencies as worked out by Dr. W. A. Roach at East Malling.* Injection can be through leaf or branch. If the leaf is used response is limited to change of colour, but a large number of substances can be tried on the same tree. Branch injections may result in responses in shoot growth, formation of new leaves, blossom formation or fruit growth, but the number of simultaneous trials is limited to the number of branches on the tree.

434. BANE, W. A. 631.8 : 634.11 + 634.13

Manurial experiments with apples and pears at East Malling, 1919-38.

Sci. Hort., 1939, 7 : 45-9, reprinted *A.R. E.Malling Res. Stat.*, 1938, A22, 1939, pp. 205-12.

Preliminary experiments with apples. Unmanured trees on land in good heart grew quite as strongly as manured trees (dung, shoddy, meat and bone meal) for the first 6 years but subsequently fell behind. The manured trees showed that response varied with variety and rootstock. Subsequently heavy dressings of potassium and nitrogen rapidly restored the starved trees to vigour and cropping. *Large scale experiments.* These consisted of 3 acres of 2-year-old Cox's Orange Pippin and Beauty of Bath on the main groups of rootstocks planted on land sown to unmanured cereal crops for 4 years previously. Nitrogen, potassium and phosphorus were applied singly, and in all possible combinations. Potassium during the first seven years has been the limiting factor of growth. Leaf scorch was severe on all no-potash plots. There were stock and varietal differences in response to potash which are described. The last two years there has been severe die-back, especially on the potash-starved trees, which now receive an annual potash dressing. Lack of humus was also thought to be

* For a full account of this, including detail of technique, see *Plant injection for diagnostic and curative purposes*, by W. A. Roach, *Tech. Comm. Imperial Bureau of Horticulture and Plantation Crops*, 10, 1938. 5s.

involved and half the plot has therefore been dressed with humus made by the Indore process. Nitrogen and phosphorus seem to have played a small part compared with potassium but there are indications that response of the tree varies according to variety and rootstock. *Effect of nitro-chalk on trees in grass.* A 3-year experiment to discover whether nitrogen deficiency could be made good by the application of nitro-chalk through grass on 20-year-old trees showed that very heavy dressings of nitrogen are unsuitable for Worcester Pearmain and that the normal dressing of 5 cwt. nitro-chalk gave good quality fruit with heavy foliage and shoot growth with trees on most rootstocks. The quantity now given in any one year is based on the appearance of the trees. *Preliminary experiments on pears.* Some notes are given of the conditions of a preliminary manurial experiment on pears started in 1934-5.

435. WANDER, I. W., AND GOURLEY, J. H. 634.11-1.58-1.416.4
Available potassium in orchard soils as affected by a heavy straw mulch.
J. Amer. Soc. Agron., 1938, 30 : 438-46, bibl. 6.

The observations, which with the technique employed in taking them are described here, were made in apple orchards, both manured and unmanured, under mulch, sod and cultivated with cover crops, on a silt loam soil. On grass plots and plots under clean cultivation with cover crops which had received K fertilizer, "quick" tests showed that there had been no appreciable downward movement of K beyond a depth of 6". The treatments had covered 10 years during which increasing potash applications had been made. In 1938 potash fertilizers were being applied at 300 lb. per acre per year on the area under the trees. Quantitative determinations of the replaceable K of soil under a heavy mulch maintained for from 22-38 years, to which no K other than that supplied by the mulch had been given, showed that available K was very high to a depth of 24-32". This was in contrast to smaller amounts found in plots in cultivation with cover crops. Finally available K was found to be low to very low in an adjacent unmanured field plot.

436. KESSLER, H. 664.85 : 631.8 + 631.542
 Die Beeinflussung der Haltbarkeit des Lagerobstes durch verschiedene
 Baumpfleagemassnahmen. (**The effect of cultural practice on storage quality.**)
 Reprinted from *Landw. Jb. Schweiz*, 1938, pp. 868-96, bibl. 17.

The effect of various tree treatments on the keeping quality of apples was studied and the following conclusions reached :—(1) Hard-pruned and hard-thinned trees bore fruits that were less resistant to storage diseases, especially where the crop was a poor one. Fruits from ringed branches from which one-third of the original fruits had been removed by thinning also showed very poor storage quality. Ringing or thinning alone did not necessarily affect the keeping quality. Fruits from ringed and partly defoliated branches stored just as well as fruits from control branches. (2) Generally speaking the keeping quality deteriorates as the ratio total leaf area : number of fruits requiring nutrients changes in favour of the former. In other words, where the carbohydrate reserves are ample and the numbers of fruits relatively small, these fruits ripen prematurely and consequently are of poor keeping quality. (3) Observations made on apples picked at different stages showed that fruits of such varieties as are subject to browning of the flesh must not be picked too late. (4) In order to get the best storage results with any variety, every step should be taken to avoid practices which might limit cropping for a considerable time or induce biennial bearing at an early stage. Trees adequately sprayed and manured and hence giving good and regular yields are found to yield fruit most likely to store well.

437. GRUBB, N. H. 634.11-1.542
Winter pruning trials with apples at East Malling.
Sci. Hort., 1939, 7 : 24-32, bibl. 3.

The winter pruning trials with apples at East Malling are concerned with three methods :—regulating, i.e. keeping the head open with no shortening of leaders but with some spur pruning ;

leader shortening or tipping; spur pruning, particularly to different lengths. The effects of the treatments were studied on growth, tree characters other than size, precocity, fruit quality, susceptibility to disease. Later work has been designed to clear up problems arising in the trial.

Tree size. Leader tipped trees of every variety were smaller in height, spread and usually in stem size than unpruned and regulated trees; in later years they often became larger having had in youth a chance to grow instead of cropping, fruit bearing being almost always delayed by leader tipping.

Other characters. Leader tipped trees have stiffer branches than untipped trees and maintain their shape better as a result, for the fruit is concentrated more in the centre of the tree rather than at the ends of the branches. Leader tipping reduces bare wood by furnishing it with spurs. Unpruned trees usually have fewer spurs than regulated ones owing to the density of the heads shading out many of the spurs on the lower branches.

Precocity. Branch pruning reduces blossom but at East Malling the effect on crop was insignificant. Reduction in blossom of regulated trees seems to be due solely to lack of room on the tree compared with unpruned trees. Reduction of blossom in leader tipped trees seems to be due to delayed maturity.

Fruit quality. Without thinning unpruned trees produced the smallest fruit and the leader tipped trees the largest.

Colour. In the first few years the regulated trees bore better coloured fruit than unpruned and leader tipped trees since their fruit was more exposed. In later years fruit colour was less affected since the only fruiting possible on the densely foliated unpruned trees was on the outside and the shade from vigorous shoot growth in fruit bearing parts of the leader tipped trees was also reduced.

Susceptibility to disease. Leader tipped trees were nearly always comparatively free from disease; leaf scorch immunity however did not persist beyond the early period of delayed maturity.

Varietal response. Severe tipping, two-thirds the length of the leader, proved too severe for any of the so-called weak-growing and for most of the medium-growing varieties. Grouping of varieties for pruning should be based on habit of growth and fruit bearing, necessity for furnishing of branches, and susceptibility to disease rather than on vigour of growth.

Spur pruning. Long spur pruning gave a definitely better result than short spur pruning.

Pruning mature trees. Response to severe pruning varied with the condition of the trees. Some of the results obtained are discussed.

Biennial bearing. Experiments showed that this could be best countered by pruning in the off year when buds are few.

438. GREVE, E. W.

634.11-1.542

A comparison of pruned and unpruned trees during the first ten years in the apple orchard.

Trans. Peninsula hort. Soc. 1938, 1939, pp. 45-55, bibl. 12.

The experiments described here were conducted on the following apple varieties, half being on their own roots, half on seedling roots: Yellow Transparent (40 pruned and 40 unpruned), Stayman Winesap (40 pruned and 40 unpruned), Delicious (40 pruned and 40 unpruned), Grimes Golden (80 pruned and 80 unpruned) and Rome Beauty (120 pruned and 120 unpruned). The orchard was under a cultivation and cover crop system. Nitrate of soda was applied each spring and 75 lb. muriate of potash and 250 lb. superphosphate per acre were applied at the time of sowing the cover crop. The author summarizes his results as follows: 1. In general the trunk circumferences of the unpruned were larger than those of the pruned trees. 2. In most cases longer terminal growths were made by the pruned than by the unpruned trees. 3. When all five varieties are considered together the unpruned greatly outyielded the pruned trees. 4. . . . size and colour of fruit were maintained on unpruned trees of Delicious, Stayman Winesap and Rome Beauty. With the Yellow Transparent and Grimes Golden colour is no factor, but the size of the fruit from the unpruned has become noticeably smaller than that from the pruned trees. The author advocates that during the first two or three years pruning must be used to secure a good framework. After this he thinks that little if any pruning should then be necessary until such time as the fruit tends to go off in size or colour. The exact procedure would necessarily vary with the variety.

SMALL FRUITS, VINES, NUTS.

439. WILLIAMS, C. F. 634.711
The Dixie red raspberry.

Ext. Circ. N.C. agric. Exp. Sta. 227, 1938, pp. 7.

At the North Carolina Experiment Station a red raspberry has been introduced under the name "Dixie". It appears to have the desirable characters of disease resistance and suitability to the local climatic conditions. It was obtained from the cross *Rubus biflorus* × Latham.

440. BEAKBANE, A. B. 634.714/717 + 631.635.7
Trials of loganberries, blackberries and hybrid berries at East Malling.

Sci. Hort., 1939, 7: 64-70.

GARNER, R. J.

Note on propagation by leaf-bud cuttings.

Ibidem, p. 70.

It is noted that the loganberry of commerce has become an extremely mixed race and that until a true clonal race has been established the chances of a grower obtaining an unmixed plantation of the true loganberry as originally described is small. Such a clonal race is, however, now being raised at East Malling and should be available for distribution to members in the autumn of 1940. Apart from the poor yields of untrue stock the falling off in yield of recent years can also be attributed to the increasing spread of cane spot (*Elsinoë veneta*) which is difficult to control by the methods used with raspberry owing to the summer spores delaying their appearance until the leaves are present and susceptible to spray damage. A partial control can be obtained by training the young cane away from the old, since the spores are distributed by rainfall in a downward direction only, and by cutting out the old cane as soon as possible. Four methods of training embodying this principle are under investigation. In the illustrations provided they are entitled respectively fan, one-way on wirework, one way on single wirework, and weaving. A brief account of the spraying programme is given. Phenomenal Berry which was included in the trial has had consistently much less cane spot than the loganberry. Phenomenal Berry has certain advantages in fruit colour and size but is very seriously affected by dwarf disease to which the re-selected clonal loganberry appears to be immune. Notes are given of varietal trials with a number of hybrid berries. Youngberry is among the most promising both as a canning and fresh market fruit. It is, however, known to be susceptible to dwarf disease, though so far it has not developed it at East Malling. The method of propagation by tip-layering from plants especially set aside for the purpose is described. Garner contributes a note on propagation by leaf bud cuttings from July to September. The material consists of a leaf, its axillary bud and small piece of stem tissue, cut from the parent shoot as if in preparation for a shield bud, i.e. without penetrating to the soft pith in the centre of the stem. These cuttings are set under glass in cold frames which in 6 to 8 weeks may be taken away and used again. The rooted cuttings are transplanted in March.

441. WILLIAMS, C. F. 634.717
Culture of the Cameron dewberry.

Ext. Circ. N. C. agric. Exp. Sta. 226, 1938, pp. 8.

A new dewberry variety has been developed by the North Carolina Experiment Station, which appears to be better suited for commercial production than the varieties Young and Lucretia on account of its improved shipping quality, disease resistance and high productiveness. This variety (Cameron) is the result of a cross between Young and Lucretia.

442. BOSMA, B. 631.83 : 634.722

De beteekenis van kalium voor de fruitgewassen in het bijzonder voor de roode bessen. (**The importance of potassium for fruit, especially red currants.**)

Meded. Tuinbouw-voorlichtingsdienst 8, 1938, pp. 34, fl. 0. 30.

The K content in the ash of many plants is great, amounting to 25% or in some cases even 50%. It is influenced by several factors including the following:—the amount of available

K in the soil ; the amount of available N in the soil ; the presence of excess Ca or Na in the soil ; the condition of the soil ; the sensitiveness of the variety or the rootstock ; the rate of use. K affects the water economics of plants inasmuch as it promotes the swelling of the cell colloids and so increases the water content. Lack of K causes drying up which is seen first in the leaf edges in the form of leaf scorch. This phenomenon is most noticeable in currants but can also be seen more slightly in apples. Discolouration and drying of the leaf edge are also caused in currants by Cl damage, but are somewhat different in appearance to the above. In view of this 40% K salts cannot be used for currants. K increases the total production of assimilates, helps in the development and growth of buds and so increases the number of shoots. A liberal amount of K raises the chance of fruit setting and usually raises the sugar content of the fruit. Currants and very probably apples also need large quantities of potash because they absorb this element only with difficulty. The following practical conclusions can be drawn : —1. The sulphate is the best for currants. 2. 40% potash salts arrest growth and lessen the crop and should not be used for currants. 3. Potash may be present in such a form in some soils as to be practically unavailable to plants which only absorb K with difficulty. This accounts for the frequently disappointing results obtained by the use of potassic manures especially with stone fruits. 4. Farmyard manure affects the availability of the potash supply favourably. 5. A good soil structure helps the work of the roots and so K assimilation. 6. The assimilation of K is influenced by the ratio of available K to Na, Ca and Mg present. 7. Only less important than the manuring in any one year is that of the previous year. 8. Tests of soil potash content are desirable.

443. DAVIS, M. B., BLAIR, D. S., ROSS, W. A., AND BERKELEY, G. H. 634.75

The strawberry and its cultivation in Canada.

Publ. Canada Dep. Agric. **621**, 1938, pp. 43, being *Fmrs' Bull.* **63** and *Rev. Bull.* **80**.

The following points in strawberry cultivation in Canada are considered :—soil and location, minerals, plant treatment, planting, care of the young plantation, renewing the plantation, irrigation, varieties, everbearing strawberries, and choice of varieties for certain districts. Common pests and diseases as well as their control are also dealt with. Three coloured plates are given showing autumn leaf symptoms of nitrogen, phosphorus and potassium deficiency respectively.

444. WELLINGTON, R. 634.75

The strawberry problem.

J. Minist. Agric., Lond., 1939, **45** : 1008-18, bibl. 13.

The author reviews the position of strawberry growing in England and discusses the serious losses which occur through virus and other diseases. The need of obtaining and maintaining virus-free stock is stressed. This precaution together with sound cultural methods will render strawberry growing less hazardous and more profitable. The author describes his own experiences with both virus-free and virus-infected stock in order to give point to his conclusions.

445. ROGERS, W. S., KING, M. E., AND MASSEE, A. M. 634.75-1.5-2.6/7-2.8

Results of researches in strawberry growing.

Sci. Hort., 1939, **7** : 71-84, bibl. 18, reprinted *A.R. E. Malling Res. Stat.* 1938, A22, 1939, pp. 223-34.

An outline of results obtained at East Malling in experimental work on strawberries. *Propagation and cultural problems.* (Rogers.) The importance of planting only selected stock of known good history is stressed. To facilitate roguing and to limit the spread of any infection plants for runner productions are planted 3 to 4 feet square. The runners from each block of 4 are laid inwards to form an isolated block allowing of cultivation between the rows without damage and permitting in the case of infection the destruction of the entire block without its having come in contact with neighbouring plants. To limit the spread of aphid-borne virus disease young plants should never be planted near old ones, as to do so is to render infection certain. Some varieties carry the virus but with masked symptoms so that roguing is impossible. These varieties, of which a list is given, should be kept away from the susceptible varieties (also listed). All healthy runners given equal chances will by the second year have developed into equally

strong plants, no matter what their original position on the stolon or size at planting. If required to crop the first year, however, the largest should be chosen. Autumn plantings give better results than spring plantings throughout the life of the plant. The most profitable planting space seems to be, for Royal Sovereign, 30-36 inches between rows and 12 to 18 inches apart within the row. It pays to deblossom the season following planting unless, as in districts where July and August planting is possible, the maiden crop may be reasonably large. The manuring of strawberry plants is not fully understood. Forty tons per acre of farmyard manure before planting gave improved results for the first 2 seasons only. Top dressings of 600 lb. per acre of meat and bone meal each spring + 230 lb. sulphate of potash in each winter have given good results. Irrigation in very dry weather has increased crops and quality. Burning straw litter in the rows soon after fruiting increased the crops and reduced the size of the plant.

Virus diseases of strawberries. (King.) The gradual deterioration of the commercial strawberry is largely due to virus disease only recently recognized as such. The symptoms of the important yellow edge virus are an absence of chlorophyll at the edges of the leaves, causing a yellow line which merges gradually into the green tissue. The leaflets also become asymmetrical and dwarfed and the petiole abnormally short and lacking in red pigmentation. There is no known cure but the disease can be kept in check by regular roguing of all infected or suspected plants and the maintenance of isolated and frequently rogued runner beds. Another important virus disease is crinkle of which there appear to be two forms known as "mild" and "severe". The disease is characterized by small chlorotic spots which cause distortion and crinkling, but the plant is not flattened as in yellow edge. Roguing of severe cases is advised. Both yellow edge and crinkle may be present in the same plant.

Some important pests of the strawberry. (Massee.) The strawberry aphid, *Capitophorus fragariae* Theo., is the vector of the strawberry virus diseases in England. No methods give complete control. The best results on a commercial scale have been obtained with a nicotine spray applied at the end of May and again in June (nicotine 95-98% 8 oz., soft soap 6-8 lb., water 100 gall.). Experiments with atomized nicotine have been very successful, but the economic aspect of the spray has not yet been studied. *Tarsonemid mite* (*Tarsonemus pallidus* Banks) severely weakens the plant and also causes symptoms difficult to distinguish from those of virus. The mite cannot be destroyed in the field but on runner plants it can be controlled by their immersion before planting for 20 minutes in water at 110° F. This treatment destroys all other pests that may be present. A nicotine dip before planting will destroy aphides as does the burning of straw litter. Mites are not affected by burning since most live deep in the crowns of the plant.

446. SCHRADER, A. L. 634.75
Plant thinning (spacing) of strawberries as it affects yields, plant growth and cultural methods.

Trans. Peninsula hort. Soc. 1938, 1939, pp. 142-6, bibl. 3.

Maryland experiments at Salisbury in 1936 proved that yields of marketable berries, i.e. those $\frac{3}{4}$ " in diameter or more, are greatly increased by plant thinning which spaced the runner plants 7" or 11" apart and so limited them to 8 plants and 5 plants respectively, resulting on an acre basis in 60,000 and 30,000 plants as compared with 600,000 plants with the matted, unthinned row. All varieties responded well to the treatment. Increased yield was due to larger size of berry. Equally good results were derived from thinning when irrigation was used. A method used successfully by one grower was to pull the runners crosswise into the space between the rows with a hay rake and then cut them off with a tool consisting of two discs attached to the frame of a one-horse row cultivator. Runner plants remaining in the beds were set by hand and allowed to root firmly before the hay rake was used.

447. CLARK, H. 634.75 + 634.711
Recent investigations with the strawberry and raspberry.

Trans. Peninsula hort. Soc. 1938, 1939, pp. 56-61.

Recent research is noted in which the following conclusions have been reached. Spacing of strawberry plants is good [see previous abstract]. Lime applications are beneficial to

strawberries on very acid soils and under New Brunswick conditions liming strawberry soils is recommended where the acidity is greater than pH 5.5. Mulching conserves moisture and keeps berries clean. Mulching improves raspberry cane growth.

448. FAES, H., AND PIGUET, G. A. 634.836.63
 Étude sur la qualité et la production de quelques cépages rouges. Ve série.
 Années 1928-1937. (**Quality and production of some red grape vines. Series 5**
1928-37.)

Reprinted from *Annu. agric. Suisse* 1938, pp. 897-912.

Sugar content and yields of red grape vine varieties have been studied over a considerable period at Lausanne. The conclusions reached may be summed up as follows:—(1) Limburger vines produce high yields. The sugar content of the grapes, however, is low; (2) good quality vines of the Pinot group are poor yielders, but their quality is superior to that of any other variety. A possible improvement of the productiveness of this group through selection is indicated. (3) Gamay vines were found to produce high yields of grapes containing almost as large amounts of sugar as the Pinots. (4) Franc Noir, Béclan, Cabernet, Sainte-Foix, Plant de la Loire and Lyonnais were fairly satisfactory both as regards yield and sugar content. Yearly fluctuations, however, were noted in both respects. The work with these vines is being continued. (5) Gros Rouge (Mondeuse) vines were found altogether unsatisfactory on account of the high acid content in grapes, and should be replaced.

449. WINKLER, A. J., AND WILLIAMS, W. O. 634.8 : 581.192
Carbohydrate metabolism of *Vitis vinifera* hemicellulose.
Plant Physiol., 1938, 13 : 381-90, bibl. 43.

" . . . the data of this investigation obtained from *Vitis vinifera* stems fail to show any indication of the metabolic utilization of hemicellulose and support the theory that hemicellulose does not function as a reserve material in the vine even as a reserve of 'last resort'. The data further indicate that hemicellulose probably functions as a structural material." [From authors' summary.]

450. MANZONI, L. 634.8 : 581.144
 Peso specifico in tralci e radici di vite. (**Specific weight in vine shoots and roots.**)
 Reprinted from *Annu. Staz. sper. Vitic. Conegliano*, 1937-8, Vol. 8, pp. 32, bibl. 8.

These experiments were made to clear up the confusion in which previous investigations had ended. The methods used in the present experiment are described and the results are summarized as follows:—The specific weight of lignified shoots varies appreciably at one and the same time according to variety. It shows very slight differences in the successive internodes of a given shoot up to the time when these are properly ripe, usually, but not always, being highest in the lower internodes. It is always highest in the roots (1.160-1.181). It is just above unity in green shoots in June. It falls constantly and appreciably at the end of spring, in June, after the rapid development of new organs, both in the shoots of the previous year and in the roots and in rooted cuttings. It falls very markedly in the roots of vines which have dried off as the result of imperfect union. The percentage weight and volume of dry matter are correlated with the specific weight. The specific weight of dry substance remains more or less uniform at from 1.450-1.580 in the different organs at different times.

451. EZIO, E. 634.8 : 581.144.1 : 581.192
 Variazioni enzimatiche nei tralci della vite. (**Enzymes in vine shoots.**)
 Reprinted from *Ann. Chim. appl., Roma*, 1938, 28 : 87-94, bibl. 8.

Observations on certain enzymes which are found in vine shoots, such as oxidases, peroxidases, catalases, pectases, etc., during the growth, ripening and lignification of the shoots, show that the enzyme content of shoots falls fairly quickly in the first year of life and afterwards more

slowly. The theory recently enunciated that the enzymes of this plant migrate from one part to another is not confirmed.

452. BODE, H. R. 632.8 : 634.8
Über "unechte" intracelluläre Stabbildung in sekundären Zuwachszonen einiger Pflanzen. (The formation of "false" intracellular rods in secondary callusing zones of certain plants.)
Gartenbauwiss., 1939, 12 : 399-5, bibl. 9.

The development of intracellular rods in the cambium of vines has been previously described (*Ibidem*, 1937, 11 : 272-8, *H.A.*, 7 : 891). This paper deals with the formation of what the writer describes as "false rods". The phenomenon is accounted for by the presence of a foreign body in the cell, the latter being in this particular instance the salivary gland of a coccid. However, both kinds of rods have a similar effect on formation by the daughter cells of a mass of intracellular rods, which, as the wood matures, can be scarcely distinguished from one another.

453. MANNING, W. E. 586.28 : 581.46
The morphology of the flowers of the *Juglandaceae*. I. The inflorescence.
Amer. J. Bot., 1938, 25 : 407-19, bibl. 17.

The inflorescences of all six genera of the family are described and illustrated.

454. WITT, A. W. 634.51
Walnuts. A survey of the investigations on the propagation and testing of walnuts at the East Malling Research Station.
Quart. J. For., 1939, 33 : 6-13.

This is a brief, concise and very readable account of recent English work on walnuts. *Root-stocks*. *Juglans nigra* is eminently suitable for planting in cultivated land. *J. regia* is a good stock but not so suitable for cultivated land. *J. Sieboldiana* and *J. cinerea* appear suitable on somewhat shallow soils for the production of moderate-sized trees. *Budding and grafting*. Cold wet summers hinder good take of buds. In other years considerable success has attended ring-budding. Trial is now being made of different times, buds being inserted at fortnightly intervals from the end of May to mid-August into one-year-old shoots produced by heading back. Grafting under glass in March is still the most successful method of propagation. Grafting in July with young leafed shoots also gives good results. *Frost injury*. This is the chief limiting factor in this country. A bad frost during the fortnight between the date when the bud-scales loosen and the leaflets become visible and the earliest subsequent date at which the tree is in full leaf may spoil the entire crop. For English conditions late leafing-out is essential. *Small garden trees*. These may generally be obtained as follows :—Plant a grafted tree in only fairly good soil. When the young shoots have made 5 or 6 shoots, pinch out not more than 1 cm. from the top of the growing tip with the finger and thumb. This pinching should be done on all fairly strong shoots throughout the growing season every year. If the tree still persists in excessive growth, lift it in October and replant at once *in situ*. *Varieties recommended for English conditions*. Notes are given on the following suitable varieties :—1. French—Franquette, Mayette, Meylanaise, Treyve ; 2. English—(a) dessert nuts—Excelsior of Taunton, Champion of Ixworth, Stutton Seedlings, Lady Irene, Northdown Clawnut (*J. regia maxima*), (b) for pickling—Leeds Castle and Patching. Less detailed particulars are given of some 40 other varieties, chiefly *J. regia*, the scions of which have been collected from many countries, and are now being grown in duplicate in England to discover their value for English conditions. The three following varieties have been collected for their presumed potential timber value :—Barrington Park, Kashmir A (*J. regia Koamina*), Lamb (*J. nigra*). Cultural notes are also given on pollination features, damage by rooks, abnormal nut development probably due to bad weather in summer and early autumn, and transplanting. In England the latter half of November is generally best for transplanting. The roots must never be allowed to dry out. In planting they should be spread with a downward tendency. They may be shortened by cutting, but should never be doubled upwards. Trees of from 1-5 years old are best for planting. The walnut will usually succeed where the oak does well, but never on a waterlogged soil.

PLANT PROTECTION OF DECIDUOUS FRUITS.

455. GOULD, H. P. 634.1/7-2.1
Why fruit trees fail to bear.
Leaflet. U.S. Dep. Agric., 172, 1939, pp. 5.

The more common reasons for the failure of deciduous fruit trees to bear are discussed under the following heads: age, adverse temperatures and other weather conditions, self-sterility, nutritional condition of the tree, pruning in relation to production, and dioecious species, as in the persimmon.

456. STEVENS, N. E. 632.9
Departures from ordinary methods in controlling plant diseases.
Bot. Rev., 1938, 4 : 429-45, 677-8, bibl. 52 +4.

Among disease control methods, which are not apparently known to all, the author mentions and discusses briefly the following:—the use of impregnated wraps to prevent rotting in stored fruit; the use of oil or wax directly on the fruit for the same purpose; low temperature gas storage including ozone; heat treatment of seeds by hot water, steam or direct sun's rays; heat treatment to control nematodes of such plants as strawberries, chrysanthemums, violets, begonias; heat treatment of virus-infected plants, e.g. peach yellows, etc.; seed fermentation; allowing seed to become old before planting, e.g. celery seed when infected with celery blight *Septoria Apii*; alternate changes in soil acidity, e.g. for combating such diseases as *Bacterium Solanacearum* E.F.S.; trenching and making trench barriers containing mixtures of soil and heavy oils, ammonia, sulphur and salt; double-working of apple trees to prevent collar rot, *Phytophthora Cactorum*; firing to check loss caused in *Pirus palustris* seedlings by *Septoria acicola*; inclining seedlings in one rather than another direction, thus affecting shade conditions; accelerating the melting of snow by the use of a warmth-promoting fertilizer or other means; prevention of leaf drop in cranberries by ensuring that, if flooding is adopted in cranberry bogs to protect the vines, the whole of this water freezes or, if not, that any water remaining is run off letting the ice sink down on the vines.

457. CORNFORD, C. E. 632.111 : 634.1/7
Frost and fruit-growing.
J. Minist. Agric., Lond., 1939, 45 : 981-91.

An account is given of the research work on the problem of frost incidence in progress at East Malling. There are some useful notes on the technique of orchard heater trials. Practical conclusions drawn are—(1) Frost damage in orchards on relatively high land, particularly if facing north, may be reduced by exposing the field in a requisite degree to the hilltop winds. (2) The temperature of the orchard air, especially in plains and valleys, might be raised by cultural methods designed to store up the sun's heat in the soil. (3) Temperature variation caused by topography and vegetation may account in part for the unexpected results sometimes obtained with orchard heaters. (4) It is wasteful to use orchard heaters in an orchard of widely spaced bush trees where the ground is covered with long rough grass and weeds, because the hot air produced by the heaters may be counterbalanced by the cold air produced by the exposed grass. The grass should be cut and put round the trunks where it is not exposed to the sky. (5) Orchard heating may be decreased in effectiveness by the hill-top and katabatic winds occurring on sloping ground even on nights that seem calm.

458. CORNFORD, C. E. 632.111 : 634.1/2
Researches into the cause and prevention of frost damage.
Sci. Hort., 1939, 7 : 60-3, bibl. 1.

The author gives an account of some of this research into the cause and prevention of frost damage to orchards in England. The account is an abbreviated version of fuller reports published recently in other journals* and abstracted at some length in *H.A.*, Vol. IX.

* *Quart. J. roy. met. Soc.*, 1938, 64 : 553-87. *H.A.*, 9 : 87. *J. Pomol.*, 1939, 16 : 291-319. *H.A.*, 9 : 88.

459. AUBERT, P. 632.111 : 634.1/7
 Les dommages causés aux arbres fruitiers par les gelées d'avril 1938. (**Frost damage to fruit trees in Switzerland in April, 1938.**)
 Reprinted from *Terre vaud.* 1938, pp. 4.

The severe frost of April, 1938, enabled the author to form an opinion of the hardiness of certain varieties of apricots, peaches, cherries, pears, apples and plums in certain parts of Switzerland.

460. FAES, H. 632.111 : 634.8
 La protection contre les gelées par les capuchons de paille et de papier. (**Straw and paper covers for frost protection in the vineyard.**)
 Reprinted from *Chron. vit.*, No. 18, April, 1938, pp. 3.

In 1938 more frost damage occurred at Pully experiment station on vines that had been covered with paper and straw than on controls. This is attributed to abnormal temperature conditions and dry winds in spring, which affected the protected more than the unprotected plants, since the former had been forced into soft and too early growth by their protective coverings.

461. HORSFALL, F., JR., AND VINSON, C. G. 634.11-2.111
Hardiness investigations with the apple.
Res. Bull. Mo. agric. Exp. Sta. 289, 1938, p. 24, bibl. 5.

Microchemically, no difference was found in the amount of starch, and only slight difference in carbohydrate content, in the vascular rays of crotch, trunk or lower part of the scaffold branches of ringed or trenched Grimes apple trees. The differences found in the tissues were not considered significant in regard to the treatments given. Defoliating the branches in autumn had a devitalizing effect. The earlier defoliation was carried out, the more marked became the lack of vigour shown by the delay in leaf development and flowering and by decreased shoot growth. The reduced carbohydrate supply due to premature loss of leaves is considered likely to lower the degree of hardiness. A smaller yearly increment of xylem on the upper side of scaffold branches was recorded. This is ascribed to remoteness from the leaves. The delayed maturity of crotch tissues is likely to be due to inadequate nutrient supply of the upper scaffold branches. The removal of the latter may result in winter-killing of the trunk area that depends on leaves attached to that branch. The lower a crotch on the trunk and the farther it is away from the foliage in general the lower is the crotch hardiness. Resistance of crotch tissues to low temperatures is also partly determined by width of the crotch angle, tissues in crotches of wide angle being less frequently found injured by cold. Apparently tissues of such crotches mature earlier. [From authors' summary.]

462. STUCKEY, I. H., AND CURTIS, O. F. 632.111
Ice formation and the death of plant cells by freezing.
Plant Physiol., 1938, 13 : 815-33, bibl. 26.

A technique is described for direct microscopical observation of the freezing of living cells. The material used in the present experiment was *Sedum acre* L. isolated cells, *Zebrina pendula* Schnizl. stamen hairs, and *Polypodium aureum* L. with large irregular plastids. The evidence procured here and by other workers "strongly suggests that the death of plant tissues at freezing temperatures is caused by mechanical injury resulting from ice formation within the cells. Anything which will decrease the amount of free water within the cell at the time of freezing is likely to decrease the possibilities of ice formation within the cytoplasm and thus increase the resistance of the cell to freezing temperatures".

463. LÖHNIS, M. P. 634.722-2.19
 Ziekteverschijnselen bij aalbessen veroorzaakt door de minerale voeding.
 (**Injury to red currants due to malnutrition.**) [English summary 3 pp.]
Tijdschr. PlZiekt., 1937, 43 : 33-56, bibl. 21.

For those interested in the phenomena seen in red currants when certain nutrient elements are withheld or in excess this article can be recommended. In pot experiments which extended

over several years the author studied injury due to potassium chloride, to potassium deficiency, to boron deficiency and finally injuries which occurred in the presence of sodium and potassium sulphates and sodium and potassium nitrates.

464. KACZMAREK, A. 634.8-2.19
 Untersuchungen über den Rückgang von Pfropfreben in Neuanlagen des
 Saale- und Unstrutgebietes. (**Failure of grafted vines in Germany.**)
Gartenbauwiss., 1939, 12 : 420-509, bibl., p. 3.

In 1925-30 the failure of young grafted vines in the Saale and Unstrut districts was considerably above the average. In the search for an explanation the following questions were studied: physiology and nutrition, plant material (faulty stock, immature wood), incorrect handling of the material, unfavourable local conditions (soil, climate), the effect of parasites and viruses. The results of the study, which are tabulated, are discussed at length. It appears that the failure was mainly due to unfavourable soil and soil moisture conditions.

465. BODE, H. R. 634.8-2.8
 Beiträge zur Kenntnis der Reisigkrankheit der Rebe. (**Contributions to the
 knowledge of the "Reisig" disease of vines.**)
Gartenbauwiss., 1939, 12 : 406-19, bibl. 7.

Further investigations* are reported on the cause and nature of the "reisig" disease of vines. Among other points now established are that the appearance of double or short nodes is not determined by low temperatures, that boron deficiency symptoms differ entirely from reisig symptoms, that whether the disease will show itself or not is determined before the new shoots start into growth.

466. REINECKE, O. S. H. 634.1/8-2.19
 Little leaf of deciduous fruit trees.
Fmg S. Afr., 1938, 13 : 386-90.

Little leaf is a disease which has appeared on deciduous fruit trees in various parts of the world. The usual symptoms are the formation of small, stiff, nearly sessile, leaves in the first flush of growth in spring combined with a notable lack of vigour in the upper parts of the tree. The application of zinc in one form or another has usually effected a cure. Deciduous fruit trees respond best to zinc sulphate without lime applied in concentrated form as a spray in winter. Grapes are best treated by swabbing the pruning wounds with zinc sulphate, at any rate in short-pruned vines. The driving in of four pieces of galvanized iron for each inch of trunk circumference has proved effective on vines large enough to have somewhat rigid stems. In California it has been found that weak Muscat vines not obviously suffering from little leaf make striking growth and yield response when the pruning cuts are swabbed with zinc directly after the operation.

467. OSERKOWSKY, J., AND THOMAS, H. E. 632.19 : 634.13-1.454
 Exanthema in pear and copper deficiency.
Plant Physiol., 1938, 13 : 451-67, bibl. 10.

The paper deals with the so-called exanthema† disease of Bartlett (Williams') pear trees in two orchards in the coastal region of central California. The symptoms are briefly as follows:—In early summer the tips of the current-year shoots and the tips of the terminal shoot leaves turn brown and die. This dying progresses downwards and by the end of the summer three-quarters of the current year's growth may be dead. Affected trees often present a semi-witches'-broom appearance owing to shoot growth from axillary buds stimulated by the death of the apical points. They bear practically no fruit. In pear trees only a very characteristic symptom

* See *Ibidem*, 1935, 10 : 110-50. *H.A.*, 6 : 479.

† See *H.A.*, 6 : 851.

is an alternate brown-orange striation running parallel with the outline of the leaf in the dead parts of many of the leaves. It seems to be due to soil conditions. The copper content of the leaves and shoots from trees in the affected area is lower than in localities free from the disease. On the other hand within affected orchards there is no consistent difference in the copper content of healthy and diseased trees. Trees suffering from it can be cured by applying copper salts to the soil, introducing crystals of copper salts into the root crown of the tree, or by spraying with bordeaux. That the beneficial action is specific to copper is shown by the fact that exanthema was not corrected by treatment with any of the following salts: MnCl_2 , ZnSO_4 , ferric citrate, $\text{K}_2\text{Cr}_2(\text{SO}_4)_3$, NaVO_3 , CdSO_4 , $\text{Co}(\text{NO}_3)_2$ and $\text{Ni}(\text{NO}_3)_2$.

468. ESAU, K. 632.8 : 581.1

Some anatomical aspects of plant virus disease problems.

Bot. Rev., 1938, 4 : 548-79, bibl. 146.

This paper provides a very useful summary of the literature on the anatomy of virus diseased plants. After detailing the nature of the anatomical modifications induced in plants by virus diseases, the writer discusses how these may help in the classification of plant viruses. Histological and cytological changes in diseased plants provide valuable information on the plant tissue relations of certain viruses, and help to elucidate the problems of virus movement within the plant. In curly-top of sugar beet and other diseases they support the conclusion that the virus is localized and carried in the phloem. Finally the writer discusses phloem abnormalities in healthy and diseased plants, stressing the fact that a thorough study of the developmental changes in the healthy tissue should be made before attempting to relate supposed abnormalities to the presence of virus disease. Throughout the paper references to all types of virus diseases are made but special discussion is given to potato virus diseases and the curly-top disease of sugar beet, since these have been studied in greater detail. M.E.K.

469. EDWARDS, W. D., AND ZELLER, S. M. 634.75-2.3/4 + 2.6/7

Insect pests and diseases of strawberry in Oregon.

Sta. Bull. Ore. agri. Exp. Sta., 357, 1938, p. 29.

All the more common pests and diseases attacking strawberries in the north-west of the United States are here discussed, and control measures are suggested.

470. RANDELL, S. E. 634.8-1.84-2.4

Nitrogen and mould.

J. Dep. Agric. S. Aust., 1938, 41 : 1037-9.

It is argued that the spread of mould in currant vines and figs in S. Australia is not due to manuring with nitrogen or to the growing of cover crops, as is often held, but simply to an absence of cool drying winds after a period of rain. Manurial tests at the Berri Experimental Orchard have proved that for the production of heavy crops of quality fruit nitrogen is the dominant factor.

471. MEMETOV, A. 632.482 : 634.1/2

***Sphaeropsis Malorum* P. in Crimean orchards and its control.** [Russian.]

Govt Publishers Crimea, Simpheropol, 1938, pp. 20, bibl. 4.

In 1935 studies were started by the Crimean Institute of Plant Protection on *Sphaeropsis Malorum* P., a serious disease of fruit trees in the Crimea, especially of pome fruits. The symptoms of the disease on bark, leaf, flower and fruits are noted and damage described. As a result of preliminary study certain control measures are recommended. These consist essentially of (1) planting healthy specimens of resistant varieties (so far only White Winter Calville apples were not found to be affected by the disease—ED.), (2) avoiding bark injury as a precaution against infection, and (3) burning infected plants and parts of plants. In connection with these pruning and cleaning operations, pruning waxes and fungicides are discussed.

472. MCNEW, G. L. 634.11-2.44
Differential reaction of apple varieties to *Gymnosporangium Juniperi-Virginianae*.

Res. Bull. Ia agric. Exp. Sta. **245**, 1938, pp. 142, bibl. 33.

The different reactions of a large number of apple varieties grown in Iowa to *Gymnosporangium Juniperi-Virginianae* are here recorded in detail.

473. GOODWIN, W., PIZER, N. H., SALMON, E. S., AND
 WARE, W. M. 634.11-2.42
The control of apple scab : Allington Pippin and Newton Wonder, 1937.
J. S.-E. agric. Coll. Wye, 1938, No. **42**, pp. 37-41.

Cotton-seed oil-bordeaux was sprayed on Allington Pippin and Newton Wonder trees in two pre- and two post-blossom applications in 1937 and the comparative effects of the treatment on trees which had been sprayed annually since 1927 and on those which had not been sprayed during those years were noted. The percentages of scab-affected apples were as follows:—Allington Pippin treated every year 21.5 and 16.1 per cent., treated in 1937 only 32.2, 14.2 and 12.5 per cent.; Newton Wonder treated every year 24.3 and 22.3 per cent., treated in 1937 only 34.4, 23.1 and 13.2 per cent.

474. DU PLESSIS, S. J. 632.482 : 634.8 + 664.85.8
Further studies on the control of *Botrytis* rot in grapes.
Sci. Bull. Dep. Agric. S. Afr. **166**, 1938, pp. 32, bibl. 3, being *Stellenbosch-Elzenburg series 27*.

Dusting experiments showed that the efficacy of verderame (copper-oxy-chloride) sulphur dust for the control of *Botrytis* rot can be greatly increased by changing the proportions of these two components from 20 : 80, as has been used till now, to 80 : 20. Pure sulphur, applied by itself, was nearly as effective against *Botrytis* rot as pure verderame. The variance in *Botrytis* infection obtained in the various plots of the experimental block showed that the Latin-square system must be adopted for these types of trials. A slight improvement was obtained in the condition of Henab Turki grapes when they were dusted with verderame-sulphur (20 to 80) dust in the vineyard. The use of wrappers treated with a 1% iodine and 2% potassium iodide solution proved to be promising. Attempts to prevent the staining of woodwool by iodine were largely unsuccessful. Of the various chemicals in dry form paraform, formalin tablets and ammonium bicarbonate gave promising results with Henab Turki grapes. The most effective and yet safe treatment of grapes with formaldehyde solution was obtained by the application of 10 c.c. of a 6% solution to the woodwool of each box. Less satisfactory results were obtained with cotton-wool plugs soaked in formaldehyde solution. Good control of *Botrytis* rot was obtained by applying 10 c.c. of a 4% formaldehyde solution to 4.5 inch grape boxes lined with either corrugated paper or woodwool. The control was particularly satisfactory with grapes packed without wraps. The results obtained with Red Hanepoot and Henab Turki grapes packed in larger boxes were not so outstanding as desired, but it is hoped to improve upon this by increasing the strength of the formaldehyde solution to 6%. Fumigating with a 4% volumetric concentration of formaldehyde gas was found to be very effective. The fumigation of the grapes after they had been cleaned and trimmed in the packing shed proved to be much preferable to a previous fumigation. It was found that *Botrytis* and other rots increase gradually even during cold storage at 34° F. and rapidly during subsequent storage at ordinary room temperatures. The wastage during storage of Red Hanepoot and Henab Turki grapes, which were already infected when picked, was about four times as high as in other grapes. *Botrytis* infection was found to be more severe (a) in unwrapped than in wrapped grapes, (b) in grapes packed in a slanting position than in those packed flat in 4.5 inch boxes, and (c) in grapes packed in boxes lined with corrugated paper than in those packed in boxes with woodwool.

475. DU PLESSIS, S. J. 632.48 : 634.8
The occurrence of the dead-arm disease of vines in South Africa.
Sci. Bull. Dep. Agric. S. Afr. **175**, 1938, pp. 12, bibl. 5, being *Sci. Bull. Stellenbosch-Elsenburg* **29**.

This fungus disease (*Fusicoccum viticolum* Reddick) was recently found to occur in the vineyards at Stellenbosch and Somerset West, in the winter-rainfall area of the Cape Province. There is no evidence, however, to suggest the likelihood of it becoming very serious in South African vineyards. The disease and its symptoms are described, susceptible varieties of vines are noted and control measures are discussed. These consist essentially in careful, selective winter pruning and three applications of lime sulphur (1 in 120) in spring up to the time of blossoming.

476. HORSFALL, J. G. 632.41
Combating damping-off.
Bull. N.Y. St. agric. Exp. Sta. **683**, 1938, pp. 46, bibl. 43.

Two fundamental aspects of damping-off control are seed protection and soil treatment. Seed protection by means of dips and dusts is the simplest and cheapest method of control. There are three main groups of seed-protecting materials, namely copper, mercury and zinc. Plants that may be satisfactorily treated with these materials and such as may be injured by any of the protective materials are listed.

477. CHRISTOFF, A. 634.1/2 : 632.42 + 632.48
The brown rot diseases of fruit trees in Bulgaria. [Bulgarian, English summary 1 p.]
 Reprinted from *J. agric. Exp. Sta. Bulgaria*, 1938, **8** : 3 : 3-32.

Of the brown rots only *Sclerotinia fructigena* and *Sclerotinia laxa* were found to be serious diseases of pome and stone fruits in Bulgaria. *Sclerotinia fructigena* generally causes fruit rot and sometimes canker accompanied by gum flow in stone fruits. *Sclerotinia laxa* also usually affects only the fruits of pome and stone fruit trees and only in exceptionally favourable conditions causes tip, spur and twig blight, blossom wilt, canker or wilting of stools and layers in the nursery beds. The author considers that it is not justifiable to divide the *Sclerotinia laxa* species into the biological forms *Pruni* and *Mali*.

478. LINDBLOM, A. 632.6/7
 Skadedjur i Sverige år 1936. (**Agricultural pests in Sweden 1936.**)
Medd. Växtskyddsanst. Stockh. **26**, 1938, pp. 71.

This is a summary of reports from twenty-four Swedish counties on the occurrence in 1936 of insects, birds and animals causing damage to various horticultural and agricultural crops. The clear arrangement of the material, the illustrations and the index add to the value of this publication.

479. SMITH, J. H. 634.8-2.6/7
Pests of the grape vine.
Qd agric. J., 1938, **50** : 700-7.

The principal pests of the grape vine in Queensland are described and control measures suggested. The insects dealt with are phylloxera, fruit fly, grape thrips, mites, soft scales, various lepidopterous larvae and beetles.

480. HANF, M. 634.11 : 632.768
 Untersuchungen über Biologie und Bekämpfungsmöglichkeiten des Apfelblütenstechers (*Anthonomus pomorum* L.). (**Biology and control of the apple blossom weevil.**)
Gartenbauwiss., 1939, **12** : 335-98, bibl. 230.

The following measures are considered essential and are recommended for the control of *Anthonomus pomorum* L. 1. Thorough winter washing. 2. Attachment to the trees of corrugated cardboard bands in the spring; these should be daily inspected and trapped beetles destroyed.

3. Spraying prior to flowering with copper lime-lead arsenate containing some spreading agent. 4. Where the number of trees attacked by the weevil is limited, affected flower buds should be removed. 5. Renewal of the corrugated cardboard bands at the end of June. Check in August and in November when all hibernating beetles should be destroyed. 6. The hibernation of the weevils in the vicinity of apple trees should be made impossible.

481. NIKOL'SKY, V. L. 634.1/2-2.76
***Lethrus apterus* Laxm. as a pest of seedling trees.** [Russian, English summary 37 lines.]
Zashch. Rast. Vredit., 1937, No. 14, pp. 61-9, bibl. 29.

The biology and ecology of *Lethrus apterus* was studied at the Rossoshansk nursery (U.S.S.R.), where this beetle caused very serious damage to trees of various species. The stems of seedling cherry and other fruits were gnawed through while on transplanted trees the young sprouts and apical buds were nipped off. As a result the seedlings died and young trees were deformed. Basing his suggestions on experimental data, the author recommends the following control measures:—1. Keep the soil friable in autumn and spring, not only throughout the plots but also in the paths leading through the plots and along the edges. 2. Plant trees in squares with other crops growing below. 3. Destroy the beetle holes in May and collect any beetles found in them or on the soil surface. 4. Dust or spray in April-May with Paris green (20-25 g. to 10 litres of water).

482. SNAPP, O. I. 634.25-2.76
Recent experiment with ethylene dichloride emulsion for peach borer (*Canopia exitiosa* Say.) control.
J. econ. Ent., 1938, 31 : 725-7, bibl. 3.

Control of peach borer by ethylene dichloride appears to be less dangerous, more effective and cheaper than treatment with paradichlorbenzene.

483. ANON. 632.78 : 634.11
 La pyrale des pommes, *Laspeyresia (Carpocapsa) pomonella* L. (Codling moth.)
Memento Déf. Vég. Rabat., 51, 1938, p. 18.

The geographical distribution and life history of the codling moth are described. The damage caused by it is discussed and control measures are noted. These in French Morocco consist in spraying with certain known emulsions and spray mixtures and weekly trapping from mid-April to November.

484. JARY, S. G., AUSTIN, M. D., AND PITCHER, R. S. 632.654.2 : 634.723
The control of big bud mite, *Eriophyes ribis* (Westw.) Nal. by lime sulphur.
J. S.-E. agric. Coll. Wye, 1938, No. 42, pp. 82-92, bibl. 10.

When applied at the usual time, i.e. immediately prior to the flowering period, a refined petroleum oil spray, 1.6% oil concentration, was without effect in the field. Lime sulphur concentrations of 1 : 12, 1 : 30, 1 : 60 and 1 : 100 all markedly reduced infestation, the higher concentrations to a greater extent than the lower, especially in the first year. At the end of 2 years there was no significant difference in infestation in plots which had received 1 : 12 and 1 : 100. The check to foliage development induced by lime-sulphur is related to the concentration used and is more severe when frost occurs about the time of application. [From authors' summary.]

485. UNDERHILL, G. W., AND COX, J. A. 634.11-2.753
Studies on the resistance of apple to the woolly apple aphid (*Eriosoma lanigerum* Hausm.).
J. econ. Ent., 1938, 31 : 622-5.

The first 3 years' experiments to determine the resistance of certain apple varieties to woolly aphid in Virginia show that Northern Spy and Early Harvest are highly resistant and that the

16 other varieties tested are susceptible. The method of trial used was artificial infestation of the roots and observation of results.

486. PIERCE, W. C. 634.521-2.752
Control of the obscure scale (*Chrysomphalus obscurus* Comst.) on pecan with low concentrations of lubricating oil emulsions.
J. econ. Ent., 1938, 31 : 722-4, bibl. 1.

A 3% concentration of lubricating oil emulsion was the highest concentration that gave a fair measure of control of obscure scale on pecan without badly damaging the trees.

487. MINISTRY OF AGRICULTURE, LONDON. 632.754 : 634.1/7
Fruit tree capsids.

Adv. Leaf. Minist. Agric., Lond., 154, 1938, p. 4.

Control measures against apple capsid and the common green capsid consist essentially of adequate pruning and thinning, winter spraying with mineral-oil washes and nicotine dusting or spraying in the spring and summer.

488. ULLYETT, G. C. 595.796 : 632.963
Ants and beneficial insects.

Reprinted from *Fmg S. Afr.*, 1938, 13 : 120.

The problem of the desirability of ants in Cape Province orchards is examined in the light of the latest research. It is concluded that in very many cases of attempted biological control of pests ant control is essential for the optimum activity of the beneficial insects.

489. HOCKEY, J. F. 632.952
Comparison of orchard fungicides 1938.
Seventy-fifth annu. Rep. Nova Scotia Fruit Growers' Ass. (Jubilee edition)
 for 1938, pp. 53-8.

The author details the various applications made for the control of scab in 1938 and the varying success obtained. He notes that "the spray calendar giving the largest percentage of clean fruit on all varieties consisted of two bordeaux sprays followed by four applications of a mixture consisting of 1 gallon lime-sulphur, 4 lb. catalytic sulphur and 3 lb. arsenate of lead in 100 gallons water".

490. MARSH, R. W. 632.952
Some applications of laboratory biological tests to the evaluation of fungicides.
Ann. appl. Biol., 1938, 25 : 583-604, bibl. 18.

Laboratory sorting-out tests on glass slides have shown the relative fungicidal value of a number of rubber accelerators and other organic sulphur derivatives. The most toxic of these materials, when tested on leaves, gave no promise of being of use in the field. In laboratory leaf tests using spray supplements the adverse influence of sulphite lye on tenacity was illustrated by spore germination experiments. Loss of tenacity was similarly demonstrated in sprays including oils emulsified with sulphite lye. A limited number of comparisons with field trials indicates that the laboratory leaf test may be used as an indicator of the fungicidal value of a spray material against *Venturia inaequalis* and *V. pirina*, but that in general it gives results less favourable to the fungicide than those from corresponding field trials. [Author's summary.]

491. WILCOXON, F., AND MCCALLAN, S. E. A. 632.952
The weathering of bordeaux mixture.
Contr. Boyce Thompson Inst., 1938, 9 : 149-59, bibl. 9.

Natural weathering of 4-4-50 bordeaux in the open resulted in a mixture relatively richer in copper with an increase in soluble copper. The appearance of these small amounts of soluble copper must be considered a factor affecting leaf injury.

492. McCALLAN, S. E. A., AND WILCOXON, F. 632.952.21

Laboratory comparisons of copper fungicides.

Contr. Boyce Thompson Inst., 1938, **9** : 249-63, bibl. 37.

These results indicate that 50 years of experimentation with copper compounds have given us none equal to bordeaux mixture. [From authors' summary.]

493. ANON. 632.952.21

Les bouillies cupriques. (Copper washes.)

Memento Déf. Vég. Rabat, **52**, 1938, pp. 16.

The composition and preparation of some eleven copper washes are described. The sticking and spreading capacities of the washes and the possibility of combining them with certain insecticides are considered. Their effect on fungi and on peaches, pears, apples, almonds, apricots and grape vines are discussed and certain practical recommendations are made.

494. MOORE, M. H., STEER, W., AND SHAW, H. 632.952 + 632.951

Recent work on fungicides and insecticides at East Malling.*

Sci. Hort., 1939, **7** : 85-95, bibl. 15.

Investigations with fungicides (Moore). Experimental work in fungicides has been directed to the improvement in performance of such specifics as bordeaux and lime sulphur, the testing of new spray materials and a study of the environmental or physiological conditions which predispose a tree to resistance or susceptibility to disease or spray injury. Apple scab is best controlled by lime sulphur sprays 2½% at green and pink bud, 1% at petal fall, ¾% afterwards—as necessary—at fortnightly intervals, or 0.5% colloidal sulphur may be substituted for the post-petal spray. Correct timing of the early sprays is essential. New potential fungicides showing promise are a zinc-lime mixture and tetramethylthiuram disulphide. Subject to a complex of interacting factors not yet clarified there is evidence that high nitrogen conditions favour and suitable potash applications counteract the incidence of scab. For pear scab the recommended control is lime-sulphur 2½% just after bud burst and at white bud and bordeaux 4-6-100 + cotton seed oil, 3 qts. per 100 gall., at petal fall and 2 or 3 weeks afterwards. Brown rot in Morello cherries is best dealt with by cutting out the infections in spring + one application of 10% tar oil late in January and one application of bordeaux 6-9-100 just pre-blossom. On standard plums and sweet cherries cutting out of infections is often impracticable and only spraying can be used. Bacterial shot-hole and canker in the susceptible Bigarreau de Schrecken has been reduced by autumn spraying of bordeaux 10-15-100 a few weeks before leaf fall and one similar spray just before blossoming. Apple branch blister, chiefly found on Cox's Orange Pippin, has been shown to be physiological in origin, associated primarily with lack of moisture and potash. Strawberry mildew should be treated in advance of infection in late April or early May and thereafter by a regular routine of 2% lime sulphur spraying reduced to 1% in hot weather. Sulphur dust requires frequent application and is then effective.

Investigations with insecticides (Steer). The choice for the control of raspberry beetle lies between the destruction of the adults by the use of derris dust just before and again during blossoming or the destruction of the larvae by a post-application of derris and soap wash late in June. Apple sawfly is controlled by the addition of 8 oz. nicotine per 100 galls. to the petal fall scab spray. The tree should be well drenched and the spray should be given early before all the petals are off. Apple blossom weevil was 50% controlled by coating the trees with derris dust when the weevils were laying their eggs in April.

Chemical investigations (Shaw). The investigations at East Malling are considered under the headings of routine analysis, routine research and fundamental longrange investigations. Routine analysis consists largely of the examination of commercial preparations. Routine research deals with (1) spray compatibility or the reaction on each other of the various ingredients in a

* Reprinted in *A.R. E. Malling Res. Stat.* 1938, A22, 1939, pp. 253-61.

spray mixture and their combined effect on the tree ; (2) the problem of spray residues on fruit at harvest, their prevention or reduction. More fundamental research concerns investigation of the mechanism of the action of certain insecticides and fungicides. An investigation of the ovicidal properties of a low-temperature tar distillate developed into a survey of the whole range of hydrocarbon oil. Boiling-range fractions of neutral tar and petroleum distillates have been evaluated as ovicides and an attempt made to correlate the toxicity with chemical and physical properties. Against aphid and apple sucker the content of oil soluble in dimethyl sulphate is a good index of toxicity only when the distillate is of anthracene oil type. Against winter moth boiling range is the principal but not the only factor determining ovicidal action. The nature and mechanism of the toxicity of oils to insect eggs is being investigated. There is a steady building up of knowledge of the relation between chemical structure and insecticidal and ovicidal properties as a result of which a systematic and enlightened search for new materials is possible in contrast to the haphazard methods alone practicable in the past.

495. KEARNS, H. G. H., AND MARTIN, H. 632.951/2
The position of combined washes in the post-dormant spray programme.
I. The physical properties of spray-fluids with special reference to post-dormant washes. II. The use of post-dormant combined washes in fruit crops.

Sci. Hort., 1939, 7 : 96-118, bibl. 27.

Part I. Fundamental considerations are discussed concerning the physical properties of sprays in relation to their direct and protective insecticidal and fungicidal properties. Methods whereby sprays can be made suitable for overspraying without serious sacrifice of protectant qualities or increase in phytocidal action are outlined. The comparative merits of water-soluble and water-insoluble spray supplements indicate that oil emulsions afford the most promising basis of combined direct and protective sprays.

Part II. Particulars are given of the important materials used in post-dormant combined washes. Spray programmes based upon the use of combined washes are outlined for apples, plums, currants and strawberries. [Authors' summary.]

496. KELSALL, A. 632.951
Some results from insecticides.
Seventy-fifth annu. Rep. Nova Scotia Fruit Growers' Ass. (Jubilee edition) for 1938, pp. 59-61.

Against rosy aphid effective control was obtained by nicotine sulphate coal tar oil and "Dowspray Formant". Lauryl thiocyanate, derris and pyrethrum proved ineffective or uneconomic. Experimental results with several combinations used in conjunction with flotation sulphur against scab and biting insects are reported. The grey-banded leaf roller was thoroughly controlled by arsenical sprays, especially when attention was paid to the treatment of the under surface of the leaves. Trials are reported of the use of Black Leaf 155, an insoluble form of nicotine produced by a combination of nicotine sulphate and bentonite. Used at 10 lb. per 100 gallons it controlled codling. It is found to prevent deer from feeding on the foliage of treated trees, but it will not prevent them doing damage in the dormant season.

497. HEY, G. L. 632.951 : 634.1/7
Two new winter washes for fruit trees.
J. Minist. Agric., Lond., 1938, 45 : 932-40, bibl. 10.

Thiocyanate-oil wash FL applied to apples in the green tip and delayed dormant stage gave good control of aphid, capsid, woolly aphid and caterpillar without damage to the trees. Dinitro-orthocresol wash DA at 7% proved an efficient aphid ovicide at 5 centres. Comparisons of efficacy are made between these two washes and petroleum oil wash in miscible and emulsion forms.

498. McCrory, S. A., AND VINSON, C. G. 632.95
Substitute spray materials.

Res. Bull. Mo. agric. Exp. Sta. **292**, 1938, pp. 11, bibl. 5.

Attempts were made to "fix" nicotine sulfate with bentonite for a period of time sufficiently long to make it effective as a spray in codling moth control. Due to the light infestation, the protection against codling moth was not conclusive evidence. The nicotine sulfate bentonite (dry-mix) combination, especially when some sticking and spreading agent was used, gave good protection against codling moth, even when the lead arsenate calyx spray was omitted. The lead and arsenic trioxide carried in the residue at harvest were well below the respective tolerance limits. Black leaf 155 did not give a very noticeable residue on the fruit and foliage, neither did dry-mix nicotine-bentonite preparation. So conspicuous was the residue on the fruit and foliage when sprayed with nicotine sulfate bentonite (wet-mix) as to make brushing or washing of fruit necessary. Magnesium sulfate, as it was applied, was ineffective in the control of codling moth and Colorado potato beetles but seemed more effective in the control of corn ear worms. Paradichlorobenzene and beta-naphthol emulsions were applied to codling moth in the cocoon stage. Larvae in the cocoons were alive after ten days' exposure. These materials were too injurious to growing plant tissue to be used as spray materials. [Authors' summary.]

499. ANON. 632.943
 Les poudreuses. (**Dusting apparatus.**)
Memento Déf. Vég. Rabat, **11**, 1937, pp. 46.

A large number of types and makes of dusting apparatus are described and illustrated in 24 figures. They include three chief types, namely those operated by pumps, those operated by blowers and lastly, generally on a larger scale, those operated by fans. Notes on choice of implement and on the technique of applying dusts are given.

500. STAEHELIN, M. 631.462
 La désinfection partielle du sol et son application pratique. (**Partial soil disinfection and its use.**)

Reprinted from *J. Hort. Canton Vaud*, June and July, 1938, pp. 14.

Vapour sterilization is the most effective method of killing the disease germs, nematodes and insects present in the soil. When lacking the necessary equipment, gardeners are advised to use certain soil disinfectants such as formalin, Terpur, Cryptonol, etc.

501. RALSTON, W. 634.11-2.951.1
Determination of small amounts of nicotine on apples.
Industr. Engng Chem. (Analytical edition), 1938, **10**: 533-4.

The novelty of this method of determining the amount of nicotine found on sprayed apples consists essentially in washing the nicotine from the fruit with a mixture of aqueous sodium hydroxide and ethylene dichloride. From this the nicotine is recovered, distilled and precipitated with silicotungstic acid.

502. DAVIES, C., AND SMYTH-HOMEWOOD, G. R. B. 632.95
Investigations on machinery used in spraying. Part V. Tabulated results of nozzle tests.

J.S.-E. agric. Coll. Wye, 1938, No. **42**, pp. 9-36.

Here, as stated in the title, are given the tabulated results of tests conducted with 17 nozzles or groups of nozzles and 5 spray guns. Ample indication of what the figures mean is afforded

and everything is done to help the reader to appreciate the position without undue turning of pages.

503. TINCKER, M. A. 632.954
Chemical weed killers in relation to horticulture.
Ann. appl. Biol., 1938, 25 : 644-8, bibl. 17.
 MACDOWALL, R. K.
Some factors influencing the agricultural use of chemical weed killers.
Ibidem, pp. 648-52.
 BLACKMAN, G. E.
The relative toxicity of chemical weed killers.
Ibidem, pp. 652-3.
 DAWSON, R. B.
The control of weeds in lawns and fine turf.
Ibidem, pp. 653-9.
 OWEN, O.
Chlorate weed killers.
Ibidem, pp. 659-60.

These papers were read at the meeting of the Association of Applied Biologists, London, 18 March, 1938. Among weed killers whose use necessitates care but which may, under certain conditions prove useful in the orchard, the following are discussed by Tincker : sodium chlorate, cyanamide, arsenicals (little used), and sulphuric acid (untested). In grass orchards sodium chlorate has proved useful. As regards market gardens he considers that cultivation methods must still be relied on for weed eradication.

MacDowall discusses among factors which should determine the spraying or non-spraying for weeds the value of spraying only moderately weed-infested areas, the cost of machinery and its depreciation and the comparative merits of wet and dry spraying.

Blackman considers briefly the varying efficacy of particular chemicals for dealing with different weeds, even different weeds within the same genus. He notes trials on *Senecio Jacobaea* in which of sodium chlorate, sodium bichromate and sodium arsenite—after the preliminary elimination of certain other compounds—sodium chlorate proved much the most effective.

Dawson deals exclusively with the eradication of weeds in turf.

Owen considers injury which has resulted from careless use of sodium chlorate. Its danger lies in its high toxicity and in the fact that it is non-specific in its action. Among cases of injury noted are the following :—tomatoes affected by sodium chlorate in the soil ; treatment of paths outside tomato houses has often led to chlorate poisoning symptoms within ; the treatment of "standing out" ground resulting in pot contamination ; watering from a water supply contaminated by drainage from chlorate treated paths. Mild plant injury from chlorate shows a distinct mottling which is easily taken for a virus effect.

504. JARY, S. G. 632.64
"Meta-fuel" for the control of slugs and snails.
Sci. Hort., 1939, 7 : 180-5, bibl. 3.

The use of meta (metaldelyde) in the control of slugs is described. The subject has been frequently discussed in the horticultural press of late and abstracts of 2 articles* including one by the present author appeared in *H.A.*, 7 : 703 and 920. It need only be said here, therefore, that toxicity appears to be through contact, that meta is reputedly dangerous to other animals and should be used with suitable precautions and that duration of toxicity after laying down appears to be considerable ; although extremely efficacious against slugs and snails meta is ineffective against other soil pests.

* Jary, S. G. and Austen, M. D. Meta fuel and slug control. *J. S.E. agric. Coll. Wye*, 1936, No. 40 : 183-6, *H.A.*, 7 : 703.

* Gimingham, C. T. and Newton, H. C. F. A poison bait for slugs. *J. Minist. Agric., London*, 1937, 44 : 242-6, *H.A.*, 7 : 920.

505. AUSTIN, M. D., AND ROLFE, S. W. 632.693.2

The grey squirrel : a review of the present situation.

J.S.-E. agric. Coll. Wye, 1938, No. 42, pp. 93-8, bibl. 12.

The misdeeds of this fair but unpleasant rodent pest are recounted and they necessitate its elimination. It is said to be extremely good to eat. At present the most effective method of control appears to be shooting early in the year when cover is sparse.

506. HARTZELL, A. 632.754 : 634.2

Bionomics of the plum and peach leaf hopper, *Macropsis trimaculata* Fitch.

Contr. Boyce Thompson Inst., 1938, 9 : 121-36, bibl. 36.

BURGESS, A. F. 632.78

Gypsy moth and brown-tailed moth control operations during 1937.

J. econ. Ent., 1938, 31 : 587-9.

VEGETABLE GROWING,* STIMULANTS.

507. SHERRARD, G. O. 634/5

Commercial horticulture in Eire.

Sci. Hort., 1939, 7 : 119-38.

DAVIDSON, W. D. 633.491

Seed potato growing in Eire.

Ibidem, pp. 139-42.

MANNING, D. 634/5

Commercial horticulture in Devon.

Ibidem, pp. 143-9.

MACPHERSON, N. J. 634/5

Commercial horticulture in Lancashire.

Ibidem, pp. 150-60.

MOYSE, W. J. 635

Market gardening in Bedfordshire.

Ibidem, pp. 161-8, bibl. 4.

FAIRBANK, H. 634/5

The horticultural work of the Land Settlement Association.

Ibidem, pp. 194-201.

The above series contain a comprehensive survey of the commercial horticulture of the respective areas. In most cases a note is included on the present position of horticultural education.

508. LAMM, R. 635.1/7

Redogörelse för stamförsök och statskontroll av Köksväxtstammar vid statens trädgårdsförsök år 1937. (Report of the State Experiment Station for vegetables at Alnarps for 1937.)

Reprinted from *Årsskrift för Alnarps Lantbruks-Mejeri-och Trädgårdsinstitut*, 1938, pp. 166.

As a result of varietal and breeding tests conducted by the State Experiment Station a list of vegetable varieties can be given which produce in Sweden high yields, ripen early, give fine quality products and have certain other desirable characters. Among others the list includes peas and beans, cucumbers, members of the *Brassica* family, turnips, onions, sweet-corn, melons, carrots, parsnips, celery, parsley, beetroot, leeks, lettuce, radishes, spinach and tomatoes.

* See also 393, 394, 401, 650, 652, 671.

509. REIMERS, F. E. 581.143.26.03 : 635.1/7
The latest in vegetable germination and development in stages. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 12, pp. 8-12.

Experiments with onions, beetroot, turnips, lettuce, radishes and cabbage carried out by several workers tend to confirm T. D. Lysenko's theory*, namely, that "the development of a plant consists of several diverse stages and that in order to be able to pass these different stages plants require different external conditions of nutrients, light, temperature, etc." Original papers on the subject by F. E. Reimers, L. M. Dorokhov, L. V. Mikhailova and D. I. Krasilnikov are promised shortly.

510. WHATLEY, C. W. 631.544
A glasshouse unit on a mixed farm.
J. Minist. Agric., Lond., 1939, 45 : 1133-8.

An outline is given of the work on a mixed farm of 2,000 acres at Burderop, Swindon, to which have recently been added $2\frac{1}{4}$ acres of glass, on which tomatoes are grown. The author is not an advocate of catch crops chiefly on the ground that if they are late or meet a bad market they may throw back the tomato crop. It is the full, early tomato crop that brings the best return. The layout of the glass is discussed and the way in which the work of all sections of the farm is co-ordinated, though not too rigidly, is briefly described.

511. VÄXTSKYDDSANSTALT, STOCKHOLM. 632.19 : 546.27
 Sjukdomar orsakade av borbrist. (**Boron deficiency diseases.**)
Flygbl. Växtskyddsanst., Stockh., 39, 1938, pp. 5.

Beet heart rot and brown heart of swedes are both due to boron deficiency, and can be controlled by the application of borax to the soil in amounts which are mentioned. In the case of mottle disease of swedes liming proved to be harmful.

512. BOSIAN, G. 635.1/9 : 632.951.8
 Die Anwendung von Ölemulsionen in ihrer praktischen Bedeutung für die Blumen- und Gemüsegärtnerei. (**Oil emulsions in practical horticulture.**)
Gartenbauwiss., 1939, 12 : 510-9, bibl. 13.

Recent experiments with oil emulsions carried out at Geisenheim on Rhine led to the following conclusions. 1. Spraying lilies-of-the-valley with 5% linseed oil emulsion resulted in somewhat earlier and better flowering, larger bells, stronger inflorescence, a more uniform growth and a slightly brighter green of the leaves. 2. Treatment with 5% linseed oil emulsions resulted in appreciably higher yields of rhubarb, due mainly to increased stem growth. 3. Asparagus also benefited from such treatment, giving higher yields of first quality heads.

513. VÄXTSKYDDSANSTALT, STOCKHOLM. 632.19 : 546.711
 Gråfläcksjuka. (**Grey spot diseases and manganese deficiency.**)
Flygbl. Växtskyddsanst., Stockh., 38, 1938, pp. 4.

A description is given of a form of manganese deficiency disease, which, in addition to affecting cereals, affects such plants as timothy-grass, spinach, potatoes, swedes and clover.

514. OJALA, E. M. 633.491 : 581.143.26.03
Vernalization of potatoes.
N.Z. J. Agric., 1939, 38 : 15-6.

Experiments carried out during 1936 and 1937 provided no indication that the vernalization or the sprouting of potatoes before planting had any influence on yield of practical value. The vernalized potatoes did appear above ground somewhat earlier but the growth evened up by the time maturity was reached. In one year the vernalized potatoes suffered from spring frosts through appearing too soon.

* T. D. Lysenko. *Theoretical foundations for germination*, Selkhozgiz, Moscow, 1936.

515. SMITH, A. M., AND PATERSON, W. Y. 633.491-2.8
The examination of variety and virus disease in potato tubers by a chemical test.

Scot. J. Agric., 1938, **21** : 240-8, bibl. 6.

The amount of ascorbic acid or vitamin C in plant tissue may be determined by extraction and titration with an indophenol indicator solution. The procedure has been modified for the rapid routine examination of large numbers of tubers and the results show that there are important varietal differences which make it possible to separate, during the dormant season, varieties which have similar tuber characteristics. The test is also affected by the health of the tubers so that, given tubers of a particular variety, it is not difficult to decide whether they are healthy or infected with virus disease. The test is not influenced by soil conditions or manurial treatment, nor by tuber weight or greening and is apparently independent of season ; but it is affected by storage conditions. Attention is directed to the apparent connection between the ascorbic acid in different varieties and their resistance to attack by mosaic virus, and the possibility of utilizing the test in this direction is briefly discussed. [Authors' summary.]

516. TURNER, N., AND WALKER, G. L. 635.25 : 632.73
Control of onion thrips.

J. econ. Ent., 1938, **31** : 489-90, bibl. 4.

The combination of pure ground cubé root with a suitable spreader apparently protected onion plants from thrips if spraying was begun before the plants had become heavily infested.

517. GRIFFITHS, A. E. 635.52 : 631.53
Observations on the germination of lettuce seeds.

Contr. Boyce Thompson Inst., 1938, **9** : 329-37, bibl. 10.

The author presents some of the important chemical changes with special reference to the hydrolysis of fat which take place in lettuce seed during germination. The greatest activity during germination was observed about the 48th hour. From then until the 72nd hour there is a decline in activity. By the end of the 3rd day the seedling is 4-5 cm. long and, given proper conditions, is capable of manufacturing its own food supplies.

518. THOMPSON, R. C. 635.52 : 631.53
Dormancy in lettuce seed and some factors influencing its germination.

Tech. Bull. U.S. Dep. Agric. **655**, 1938, pp. 20, bibl. 12.

The environment, light, temperature, aeration, moisture and certain other factors influencing the germination of lettuce seed form a complex inter-relationship. None appears to be the sole critical element, nor can any particular combination of these factors be regarded as the most favourable environment for the germination of all lots of dormant seed. The germination capacity of nearly all lots of dormant seed may be proved by treatments that will permit the seed to be dried and stored for some time after treating. It is greatly improved by soaking the seed in water for a few hours at 5° to 15° C., exposing the moist seed to diffused light for a few hours under conditions of good aeration at a temperature below 20° and slowly drying at a low temperature. After such treatment seed may be stored for some time without losing its improved germinating capacity. Fluctuating temperatures starting low and shifting higher are more effective in the germination of dormant lettuce seed than constant high or low temperatures. Good germination results can be obtained with many lots of dormant lettuce seed by temperature control, without light exposure, provided, however, that the germination process starts at a low temperature, 5° to 10° C., followed by a subsequent shift to a higher temperature, 22° to 30° C.

519. WHITE, H. L. 635.52 : 631.53
The sterilization of lettuce seed.

Ann. appl. Biol., 1938, **25** : 767-80, bibl. 6.

Experiments show the unsuitability of standard methods of sterilization recommended for cereals and the efficacy and safety of calcium hypochlorite treatment for the sterilization of

lettuce seed. Treatment with this chemical is found also to accelerate germination, possibly as the result of increased oxygen. The method recommended is to leave the seed for 4-8 hours in a glass bottle, shaking occasionally to overcome a tendency of the seed to float, in a solution made as follows:—add bleaching powder to distilled water at the rate of 5 g. per 70 c.c. (roughly $\frac{3}{4}$ lb. to a gallon), stir, leave to settle for 5 minutes, decant and use at once. Enough should be made up to allow rejection of one-third of the liquid at decantation, just enough being left to cover the seed.

520. STEVENSON, G. B. 635.52 : 632.4
On the occurrence and spread of the ring spot disease of lettuce caused by *Marssonina panattoniana* (Berl.) Magn.
J. Pomol., 1939, 17 : 27-50, bibl. 18.

The author gives a brief account of previous observations of other workers on the incidence of the ring spot disease. It would not appear to occur significantly in lettuce grown under glass in this country, but it is an important disease of ordinary winter lettuce. Three years' trials have shown that it is readily transmitted by seed. Infected seed gives excellent germination but under suitable conditions, such as autumn sowing affords, the resulting plants show heavy infection of leaves and may be completely destroyed. The disease may also be contracted from the remains of a previous infected crop and the evidence on this point is discussed. It is thought that *Crepis capillaris*, a weed which also shows the disease, may be a source of infection. Sixteen commercial lettuce varieties tested proved equally susceptible. Reduction of incidence is effected by spraying the seedlings with bordeaux 3 : 6 : 50 or by treating the seed with a solution of bleaching powder (a process which demands care). Seed dusting has not proved successful. The disease may remain latent in a seedling crop for 2 months or more. This phenomenon is discussed.

521. MAKAROVSKY, A. F., AND SIDORENKO, M. I. 635.61
A method for increasing yields of melons and gourds. [Russian.]
Vernalization, Moscow, 1938, Nos. 4-5 (19-20), pp. 201-6.

Experiments carried out in 1937 at Novochoerkassk show that heading-back melons and water-melons is very beneficial to these plants, particularly when they are given superphosphates. All varieties studied produced higher yields when so treated, while some also bore better quality fruits. Results are tabulated.

522. YAKIMOVICH, A. D. 635.63 : 575
Heterosis in cucumber. [Russian.]
Fruits and Vegetables, Moscow, 1938, No. 12, pp. 17-9.

Heterosis effect was found in the F₁ generation of all cucumber crosses investigated, being chiefly noticeable in 40% yield increase and greater precocity of ripening. But for a single exception of a cross between *Klinsky No. 3* and *Galakhovsky*, where larger fruits were produced, increased yields were due to a greater number of fruits per plant. Data are given in tabular form.

523. GALACH'YAN, R. M. 635.63 : 632.48
The etiology of green spotting in cucumbers under conditions in Leningrad Region as a basis for control measures. [Russian, English summary 18 lines.]
Zashch. Rast. Vredit., 1937, No. 15, pp. 44-56, bibl. 19.

Bacterium lachrymans E.F.Sm. is the original cause of green spotting of cucumbers. The infection of the leaf and fruit of cucumbers, when grown under glass, is favoured by temperatures ranging between 18-24° C. The role of the fungus in this disease is only comitant, *Cladosporium herbarum* being a pure saprophyte and unable to attack a healthy plant. Eight different races or forms of *Cladosporium herbarum* have been isolated. Both the soil, seed and the remnants of the plant may be the focus of the disease. The capacity of liberating the spores from the substrata varies with the different races of the fungus. The spores of *Cladosporium* are transported by air currents. When they reach parts of the plants which have died off, they continue

their development. The amount of *Cladosporium* spores in the air and their capacity to settle down increases in proportion to the increase of the sources of infection. [Author's summary.]

524. BOLAS, B. D., MELVILLE, R., AND SELMAN, I. W. 635.64 : 581.13
The measurement of assimilation and translocation in tomato seedlings under the conditions of glasshouse culture.

Ann. Bot., Lond., 1938, **2** : 717-29, bibl. 8.

The methods described by Bolas and Melville for the measurement of assimilation rate using a "paired plant" dry weight method have been used for measuring the assimilation rate of seedling tomato plants in the greenhouse. Results of these experiments are recorded here.

525. HORSFALL, J. G., MAGIE, R. O., AND SUIT, R. F. 635.64 : 632.952.2
Bordeaux injury to tomatoes and its effect on ripening.

Tech. Bull. N.Y. St. agric. Exp. Sta. **251**, 1938, pp. 39, bibl. 24.

A study has been made of the failure of bordeaux to give increased yields of tomatoes in proportion to disease control. It was found that bordeaux did not delay ripening and that artificial defoliation did not accelerate ripening. Bordeaux dwarfed the plants, killed meristems, deformed young leaves and fruits and caused defoliation. This appreciably reduced the yield. Bordeaux also hardened the leaves, accelerated transpiration, decreased growth cracks, caused occasional russetting of the fruits and increased the tendency of the pedicel to adhere to the fruit. It had little or no effect on blossom-end rot. The leaf hardening seemed to be caused (i) by the copper and (ii) by the calcium. Curtailed blossoming appeared to be due to dwarfing. Defloration is attributed to copper toxicity, accelerated transpiration and calcium hardening. Much of the damage done by bordeaux to tomatoes appeared to result from the alkalinity of the mixture.

526. WHITE, H. L. 635.64 : 632.19 : 631.8
Further observations on the incidence of blotchy ripening of the tomato.

Ann. appl. Biol., 1938, **25** : 544-57, bibl. 8.

In plots at the Cheshunt Experimental Station it was found possible to increase the weight of fruit of K-deficient plants either by increasing the K supply or the light. This beneficial effect of increased light on the crop of K-deficient plants was much greater than any corresponding effect on the crop of N-deficient or completely manured plants. The influence of K on the production of blotchy fruit is discussed.

527. LIST, G. M. 635.64 : 632.752
Tests of certain materials as controls for the tomato psyllid, *Paratrioza cockerelli* Sule., and psyllid yellows.

J. econ. Ent., 1938, **31** : 491-7, bibl. 6.

Among a large number of sulphur preparations tested, dusting and wettable sulphur gave an increase in yield over that of the untreated checks and were found under the conditions of the experiment to be satisfactory insecticides for the tomato psyllid.

528. HEINTZE, S. G. 635.656 : 632.19 : 546.711
Readily soluble manganese of soils and marsh spot of peas.

J. agric. Sci., 1938, **28** : 175-86, bibl. 13.

Thirty-five pea soil samples collected from the Romney Marsh area, Kent, were examined. As a result it was found that marsh spot disease of peas is more closely related to soil reaction than to soil series or soil texture. The disease was not found on any acid soil, but was found on most of the alkaline soils. The soils with marsh spot contained less salt-soluble manganese than disease-free soils, but this relation depended essentially on the contrast between acid and alkaline soils. Within the alkaline group three of the five soils on which peas were free from the defect were low in salt-soluble manganese. A single extraction with normal calcium nitrate was as

effective as Steenbjerg's series of leachings with normal magnesium nitrate in characterizing the soils. Dilute acids dissolved more manganese than salt solution. Citric acid gave higher results through reducing the oxides of manganese. The acid-soluble manganese was not related to the occurrence of marsh spot. Grey speck disease of oats and speckled yellows of sugar beet were found to be due to either lack or complete absence of salt-soluble manganese in the soils. Applications of manganese sulphate which appreciably increased the salt-soluble manganese in the soils, controlled the diseases in the field. Peas grown in pots in manganese-deficient soils and in a sand-bentonite mixture developed marsh spot. Applications of manganese sulphate resulted in increased manganese content of the seeds, and controlled the disease. [From author's summary.]

529. GÜSSOW, H. T. 635.8
Mushroom culture.

Publ. Dep. Agric. Canada, 638, 1938, pp. 4, being *Circ.* 139 and *Rev. Circ.* 45.

These directions, which have been specially prepared for those taking up mushroom growing, contain notes on suitable quarters, temperature and moisture control, manure, medium for artificial culture, curing of manure, mushroom beds, spawn and spawning.

530. LAMBERT, E. B. 635.8
Principles and problems of mushroom culture.

Bot. Rev., 1938, 4 : 397-426, bibl. 166.

Most of the paper is devoted to a discussion of the growth and life cycle of cultivated *Agaricus* spp., factors affecting the growth of the mycelium, the essential features of composting and the fungal flora in the compost, possible substitutes or additions to horse manure, factors affecting mushroom development, namely casing soil, nutrition, temperature, moisture and aeration. Diseases and pests are noted. Other fleshy fungi cultivated in different parts of the world include *Cortinellus* spp. as also, to a smaller extent, *Auricularia*, *Pleurotus* and others grown in Japan and China. *Volvaria* is grown successfully on rice straw in China and elsewhere. A brief note is given on the Perigord truffle, *Tuber melanosporum*. There seems no reason why *Morchella esculenta* Fr. and *Terfezia* spp. should not also be cultivated.

531. PIZER, N. H., AND THOMPSON, A. J. 635.8
Investigations into the environment and nutrition of the cultivated mushroom. (*Psalliota campestris*). II. The effect of calcium and phosphate on growth and productivity.

J. agric. Sci., 1938, 28 : 604-17, bibl. 13.

The use of certain compounds brought about changes in the chemical composition, in the physico-chemical properties and in the structure of composted manure. Environmental conditions on the whole were more favourable to mycelial growth than to cropping, temperatures being high and humidity low. In these circumstances the effect of a particular treatment on yield is only to be inferred from the appearance of the mycelium and of the first flush. *Calcium*. There was quite definite indication that on certain kinds of manure proper mycelial growth does not occur unless a calcium compound is added. However, not all calcium compounds were found suitable. *Superphosphate*. In most of the experiments with superphosphate earlier cropping and a greater number of buttons were obtained. *Ground gypsum* was the most efficient flocculating agent tried. It was effective under both alkaline and acid conditions.

532. JARY, S. G. 635.8 : 632.654
Investigations on the insect and allied pests of cultivated mushrooms. XII. Two more tyroglyphid mites.

J. S.-E. agric. Coll. Wye, 1938, No. 42, pp. 66-81.

Full illustrated descriptions are given of two mites which have occurred on cultivated mushrooms in England recently. Possibly both are new species. They are referred to as *Caloglyphus* sp.? *berlesei* and *Eberhardia* sp.

533. HEDGES, F. 635.651 : 632.3

Bean bacterial wilt.

Leaf. U.S. Dep. Agric. 174, 1939, pp. 6, bibl. 2.

The signs of the disease, which is caused by *Bacterium flaccumfaciens* Hedges, are described, history and geographical distribution discussed and susceptible bean varieties named. This wilt appears to spread little if at all in the field, but infected seed produces infected plants, which either die in the seedling stage or produce more infected seed. Careful seed selection should be practised.

534. ANON. 635.652 : 632.3

La graisse du haricot, *Phytophthora medicaginis* var. *phaseolicola* Burkholder.

(**La graisse, a bacterial disease of the haricot bean.**)

Memento Déf. Vég. Rabat, 50, 1937, pp. 6.

The symptoms, cause, development and spread of a haricot bean disease caused by *Phytophthora Medicaginis* var. *phaseolicola* Burkholder are here described. Seed selection, seed disinfection, destruction of infected plants, crop rotation and planting of resistant varieties are recommended for its control.

535. MOORE, W. D. 635.651/3 : 632.4 + 632.8

Field studies of certain diseases of snap beans in the South East.

Tech. Bull. U.S. Dep. Agric. 647, 1938, pp. 28, bibl. 23.

The dry root rot, mosaic and damping-off disease of snap beans and their effect on yield were studied from 1931 to 1936 at the Truck Experiment Station, Charleston, S.C. The results of the trials are here discussed at some length. Data are given in tabular form.

536. SOUTH AFRICA, UNION OF. 633.71

Production of Virginia tobacco in the Union of South Africa.

Bull. Dep. Agric. S. Afr. 188, (*Plant Industry Series* 32), 1938, pp. 50.

Tobacco production in the Union is discussed under the following headings:—the seedbed, varieties, soils and fertilizers, field management, harvesting, curing and handling of cured leaf. Pests and diseases are fully dealt with.

537. CLAYTON, E. E., GAINES, J. G., SMITH, T. E., LUNN, W. M.,
AND SHAW, K. J. 633.71-2.411.4

Control of the blue mold (downy mildew) disease of tobacco by spraying.

Tech. Bull. U.S. Dep. Agric. 650, 1938, pp. 22, bibl. 10

Colloidal copper, copper-soap and calcium monosulphide gave a better control of blue-mould disease of tobacco than bordeaux mixture and many other fungicides. However, a combination of cuprous oxide with emulsified cotton seed oil was distinctly superior to any of the above.

538. ANON. 633.71-2.411.4

The use of gas in the eradication of plant diseases.

Suppl. Science, Vol. 88, No. 2287, 1938, pp. 8-10.

Benzol, xylol and tolulol vapours effectively controlled downy mildew (*Peronospora tabacina*) on tobacco plants. Laboratory trials with benzol showed that the disease could be held in check with one thirtieth the amount of vapour required to destroy the plants.

539. GUMAER, P. W. 633.71-2.411.4

Control of blue mold of tobacco with benzene vapour.

Industr. Engng Chem. (Industrial edition), 1938, 30 : 1076-81, bibl. 7.

The use of benzene to control blue mould (*Peronospora tabacina*) in tobacco seed beds was first reported by Angell in Australia in 1935. The present report describes an engineering study of gassing tobacco seed beds with benzene based on the postulate that the percentage of benzene vapour in the plant bed atmosphere throughout the night is a correct measure of the amount

of benzene which should be used. Among practical conclusions reached, the following may be noted: All fresh sporulation is stopped in 2 nights with a vapour concentration of 0.05 per cent throughout the night. Wetting cloth covers at sunset greatly increases the vapour concentration. Tightness of the plant bed and cover is more important than the distance between evaporators or the evaporation ratio.

540. CLAYTON, E. E. 633.71-2.411.4
Paradichlorbenzene as a control for blue mold disease of tobacco.
Science, 1938, **88**: 56, bibl. 1.

In the search for a material that would be simpler to use than benzol-gas, paradichlorbenzene was successfully tried for the control of downy mildew, *Peronospora tabacina* Adam. at the Coastal Plain Experiment Station, Tifton, Georgia and at the Pee Dee Experiment Station, Florence, South Carolina.

541. SALMON, E. S. 633.79
Notes on hops.
J. S.-E. agric. Coll. Wye, 1938, No. **42**, pp. 47-59, bibl. 13.

The author describes the botanical and other characters of the following new varieties raised at Wye:—Bullion Hop and Brewer's Gold, both seedlings of the wild hop of Canada (*Humulus americanus*) crossed with an unknown English male hop. Trials indicate that they are the richest varieties in the world as regards preservative qualities. At present the valuations placed by the Hops Marketing Board on new varieties capable of replacing imported hops are so low as to discourage planting them up in this country, although overseas, in Canada and the U.S.A., these varieties are being extensively planted.

542. SALMON, E. S., AND WARE, W. M. 633.79-2.411
The downy mildew of the hop in 1937.
J. S.-E. agric. Coll. Wye, 1938, No. **42**, pp. 42-6.

Hot dry weather conditions late in the season resulted in freedom from infection in the cones. For the sixth year in succession there was not a rainfall above normal in both July and August. To this mainly the authors attribute the freedom from a major disaster in these years. Cotton-seed oil-bordeaux was successfully used by many growers.

543. JARY, S. G., AND AUSTIN, M. D. 633.79-2.654.2
Tests of ovicidal washes against *Tetranychus telarius* L. on hops.
J. S.-E. agric. Coll. Wye, 1938, No. **42**, pp. 60-3, bibl. 7.

Preliminary results showed that as regards the most toxic of the substances used about 50% of the eggs were killed at concentrations ranging between 1:500 and 1:1000, so that most of the trials were carried out within this range. Three thiocyanate washes and monochloronaphthalene were tested. At a concentration of 1:250 dodecyl rhodanate was not significantly superior to monochloronaphthalene, but both were more ovicidal than the rest. At all other concentrations dodecyl rhodanate was significantly the most ovicidal of the substances under trial.

544. VAN DER HELM, G. W. 633.822
De pepermuntheelt. (Peppermint cultivation.)
Meded. Tuinbouw-Voorlichtingsdienst (Holland), **9**, 1938, pp. 88, bibl. 13,
 fl. 0.30.

A report on peppermint (*Mentha piperita* L.) cultivation in general at home and abroad with special reference to trials carried out in 1937 in Holland. The trials covered every aspect of the culture including distillation.

545. KEARNS, C. W., AND COMPTON, C. C. 632.654.2 + 632.73
The control of common red spider and thrips by the use of N, N amyl benzyl cyclohexylamine.
J. econ. Ent., 31 : 625-30, bibl. 2.
 N,N amyl benzyl cyclohexylamine is proved by laboratory and practical tests in commercial greenhouses to be an effective means of controlling red spider and thrips on a number of greenhouse and ornamental crops.
546. CHISHOLM, J. S. 635.1/7
The cultivation of vegetable crops.
 Edinburgh and East of Scotland College of Agriculture, Edinburgh, 1934,*
 pp. 16.
 Practical hints for the Scottish vegetable grower.
547. WHITE, P. R. 631.8 : 635.64 : 581.144.2
Accessory salts in the nutrition of excised tomato roots.
Plant Physiol., 1938, 13 : 391-8, bibl. 10.
 DUNLAP, A. A. 635.34
Growth of cabbage seedlings in sand culture, as affected by delayed application of nutrient salts.
Plant Physiol., 1938, 13 : 631-40, bibl. 6.
 FICHT, G. A. 635.64 : 632.651.3
Two years of study of the effects of root nematode (*Heterodera marioni* Cornu.) on the yield of canning tomatoes.
J. econ. Ent., 1938, 31 : 497-506.
 COCKERHAM, K. L., AND DEEN, O. T. 632.76 : 635.1/7
Laboratory tests with insecticides against the vegetable weevil (*Listroderes obliquus* Klug).
J. econ. Ent., 1938, 31 : 695-7, bibl. 1.
 Rotenone compounds show promise.
 SMITH, C. E., AND BRUBAKER, R. W. 635.34 : 632.78
Observations on cabbage worm populations at Baton Rouge, La.
J. econ. Ent., 1938, 31 : 697-700, bibl. 1.
 Lepidopterous pests of cabbage, cauliflower and similar vegetables.
 MADDEN, A. H., AND CHAMBERLAIN, F. S. 633.71-2.78
Biological studies of the tomato worm (*Protoparce sexta*) on tobacco.
J. econ. Ent., 1938, 31 : 703-6, bibl. 4.
 GILMORE, J. V. 633.71-2.78
Observations on the hornworms (*Protoparce* spp.) attacking tobacco in Tennessee and Kentucky.
J. econ. Ent., 1938, 31 : 706-12, bibl. 1.
 GILMORE, J. V. 633.71-2.78-2.96
Notes on *Apanteles congregatus* Say as a parasite of tobacco hornworms (*Protoparce* spp.).
J. econ. Ent., 1938, 31 : 712-5.
 SHANDS, W. A., AND MOSS, E. G. 633.71-2.76
Conditions involved in the severe losses of newly set tobacco in North Carolina, 1937.
J. econ. Ent., 1938, 31 : 715-9, bibl. 5.
 Damage due especially to flea beetles, *Epitrix parvula*.

* Received 1939.

FLOWER GROWING.*

548. CHAMINADE, R., AND BOUCHER, J. 635.939.516 : 612.014.44
 Influence de l'éclairage artificiel sur la floraison des plantes. (The effect of
 artificial lighting on flowering.)
C. R. Acad. Agric. Fr., 1938, 24 : 962-70.

The authors describe their experiments at Versailles on the influence of artificial lighting on calceolarias:—Additional lighting for 8 hours daily advanced flowering by 6-7 weeks. This was independent of the intensity of the lighting afforded. Treatment was only effective when given during the initial growth stages and was without effect from the moment when the plants had developed maximum speed of growth. The growth curves of both control and test plants took the shape of an S and were closely parallel to one another. Different fertilizer treatments were also tested at the same time, but the effect of fertilizers was definitely subsidiary to that of lighting. A note is given at the end of the paper by M. Roux that this early induced growth was to the detriment of the final development of the plants.

549. GREEN, D. E. 635.939.516 : 632.41
 Downy mildew on antirrhinum.
J. roy. hort. Soc., 1938, 63 : 159-65.

A new parasitic fungus is described which attacked *Antirrhinum majus* plants in Sussex. Disease symptoms are of the downy-mildew type; infected plants are dwarfed and the shoots appear somewhat bunched, while mealy-white patches occur on the undersides of the leaves. Conidia and oospores are described. The disease itself could not be studied, since all infected plants were destroyed at the request of the Ministry of Agriculture.

550. DOWSON, W. J., MOORE, W. C., AND OGILVIE, L. 635.938.46 : 632.3
 A bacterial disease of begonia.
J. roy. hort. Soc., 1938, 63 : 286-90, bibl. 10.

The pathogen is a yellow bacterium provisionally named *Phytomonas Begoniae* (Buchw.) Pape emend. Dows. Minute, glassy spots on the undersides of the leaves are the first symptoms of the disease on begonias. As the spots increase in size they become clearly visible as water-soaked, pale areas. Frequently two or more of them unite and thus in time the whole of the leaf may be attacked. The affected tissues are flabby at first. Later they turn brown and die. The disease can be effectively held in check by burning infected plants and practising the usual garden hygiene.

551. MOSTAFA, M. A. 582.8 : 581.144.2
 Mycorrhiza in *Tropaeolum majus* L. and *Phlox Drummondii* Hook.
Ann. Bot., Lond., 1938, 2 : 481-90, bibl. 25.

The observations described here were made in the Zaafran Palace Gardens, Cairo. The author found that both *T. majus* and *P. Drummondii* showed well-developed endotrophic mycorrhiza when grown as garden plants in a soil which was alkaline with a low humus content.

552. CORBETT, W. 635.937.34 : 631.544
 Commercial rose growing in glasshouses.
Sci. Hort., 1939, 7 : 169-73.

Only a few varieties of rose are grown under glass for the cut flower trade. The popular varieties are Richmond, Hoosier Beauty, Ophelia, Madame Butterfly, Lady Sylvia, Golden Ophelia, Roselandia, and Mrs. Herbert Stevens. These varieties have remained in favour because they crop freely and their buds are tight; loose budded varieties are useless. Propagation is sometimes by budding in the field but usually by grafting under glass on *Rosa canina* L. or *Rosa chinensis* var. *Mancttii* Dipp. Both stocks are raised from seed or cuttings according to growers'

* See also 393, 394, and 401.

preference and there is undoubtedly considerable variation within the variety. Grafting is done in January and early February and again in late July and early August. Yellows are difficult to graft in winter. The propagating house is 10-12 feet wide with a bottom-heated propagating case along one side and staging on the other. The winter method of grafting is a kind of side graft requiring considerable accuracy; the summer method is a form of bark grafting in which the scion carries two eyes. Temperature in the propagating case should be maintained at 70° F. Union, usually indicated by the unfolding of the scion's buds, should be complete in a month. A fortnight after removal from the propagating case the plants are repotted into 5-inch pots, the compost being good fibrous loam with a little well-rotted dung and bone meal. After a period in a cool house the plants are plunged in sand or ashes outside or kept in a cold, shaded house until planting in rose houses in October to December. The most suitable soil is a medium loam or brick earth. Planting space is 12 to 18 inches. The union must be above ground when the ground has settled, to prevent scion rooting. Heat is turned on in January or February. The first pruning is in February and is severe. Night temperatures before the leaf unfolds are 40-45° F., and afterwards 50-55° F. Overcropping, especially the first year, must be avoided. Watering should be little and often. Plants are rested some time during the winter, this is effected by opening all doors and ventilators and withholding water. Plants are only pruned during the rest period, but less severely than the first season. After the rest, when the houses are closed and a temperature rising to 55° F. is maintained, a top dressing of meat and bone meal is given, followed by a mulch of cow dung or stable manure in the spring.

553. WILLIAMS, P. H. 635.937.34 : 632.452

Investigations on the rust of roses (*Phragmidium mucronatum* Fr.).

Ann. appl. Biol., 1938, 25 : 730-41, bibl. 7.

Rust on roses has increased of recent years, especially on stocks grown for grafting. Severe attacks may cause heavy loss. An investigation was begun at Cheshunt at the request of the National Rose Society in 1933 and has been chiefly concerned with the possibility of cross-infection from the briar to the rose and overwintering. The results of these experiments are summarized as follows :—"Cross-inoculation experiments have shown that *Rosa laxa* and certain varieties of *R. canina* are not attacked by *Phragmidium mucronatum* from the cultivated rose, and that the rose is resistant to certain forms of the rusts on briars. These differences are correlated with differences in the size of the teleutospores. The teleutospores of *P. mucronatum* require exposure to winter conditions before they will germinate. The mycelium of the rust may persist for several years in the stem but there is no evidence of systemic infection."

554. JOHNSTONE, K. H. 635.938.422

The production of violets for market in the west country.

J. Minist. Agric., Lond., 1939, 45 : 1240-4.

The ups and downs of the violet growing industry in Cornwall and Devon are briefly reviewed. Some notes on commercial cultivation are given. The site must be sheltered and adequately provided with soil moisture to avoid drying out in summer. Soil rich in humus is necessary. Manuring may take the form of farmyard manure ploughed well in, 20 tons to the acre, or other organic manures such as hoof and horn, shoddy, etc., are often used. Inorganic fertilizers are much used in Devon. Propagation is by short sturdy runners or by division of the crowns in April. The crown in planting must be set just level with the surface. The plants are only left down one year. Spacing is 18" × 15". The plants must be kept clean by light hoeing and all runners removed. Red spider is serious in dry summers and is controlled or prevented by sulphur dusts, white oil emulsion sprays or the removal of the leaves. Clean new leaves form again later. The flowering season should be from October to April. Aphis is controlled by stripping and spraying with nicotine wash, but only before flowering. There is no standard market bunch; the most popular is of 36 flowers surrounded by 5 leaves and can be made

at the rate of 35 per hour from flowers already picked. The tie is raffia wound along the stems, rubber rings being likely to cut into the stems. Below 40° F. violets fail to open properly and must not be picked as they will not open in water. Sometimes the plants are grown in wooden frames with hessian covers which can be rolled over the plants in bad weather.

555. STEARN, W. T. 635.967.2

Epimedium and Vancouveria (Berberidaceae), a monograph.

J. Linn. Soc. (Bot.), 1939, **51** : 409-535, pls. 24-31.

This is primarily a botanical paper treating in detail the structure, geographical distribution, history, classification and nomenclature of *Epimedium* and *Vancouveria*, two closely related genera of low-growing woodland herbaceous plants cultivated in rock- and woodland-gardens for their pleasing leaves and flowers. Of the twenty-three species of *Epimedium*, seven species and eleven horticulturally distinct plants considered of hybrid origin are grown in Britain, together with the three known species of *Vancouveria*. They are described in detail and keys are provided for their recognition. All are hardy in Britain but are liable to have their flowers and first leaves damaged by frost or drying winds: they prefer cool, shady and sheltered conditions. For glasshouse decoration in March, clumps may be lifted from the outdoor garden in December or earlier, potted and kept moist and draught-free under a staging until the shoots begin to uncurl: a low temperature (about 45° F. or 8° C.) is best. [Abstract provided by author.]

556. WALLACE, J. C., AND HORTON, D. E. 635.944

The south Lincolnshire bulb industry.

J. Minist. Agric., Lond., 1939, **46** : 109-16.

An account is given of the rise of the bulb industry in south Lincolnshire and of its general organization and methods. Both cut flowers, forced and grown in the open, and bulbs are grown for sale, and the tulip and narcissus bulbs are quite able to compete for quality with the imported Dutch. Bulb production for wholesale and retail dry-bulb sale has only become of importance since the war, but is now well organized and understood, and profits are more satisfactory than those from flower growing. Most firms combine the three branches of forced flowers, out door cut flowers and bulb production.

557. DENNY, F. E. 635.944

Prolonging, then breaking, the rest period of gladiolus corms.

Contr. Boyce Thompson Inst., 1938, **9** : 403-8.

The corms of several varieties of gladiolus were held in a dormant condition for six months or longer after harvest by storing the *recently harvested* corms in moist soil either at room temperature, or preferably at 27° C. Corms whose dormancy had been maintained for seven months in soil at room temperature, when removed from the soil and treated with vapours of ethylene chlorhydrin, germinated promptly and produced blooms before the untreated control corms showed any emergence of sprouts. [Author's summary.]

558. BUDDIN, W. 635.944

Root rot, shoot rot and shanking of tulip caused by *Phytophthora cryptogea*

Pethybr. and Laff and *P. erythroseptica* Pethybr.

Ann. appl. Biol., 1938, **25** : 705-29, bibl. 20.

Phytophthora cryptogea and *P. erythroseptica* have been proved to be, either separately or in conjunction, the cause of a serious root rot, shoot rot and shanking of forced tulips. The symptoms of this disease are essentially the absence of shoots or at any rate normal flowers. It would appear to be widely distributed in Great Britain, but not to have been reported elsewhere. Partial sterilization of soil by steam or formaldehyde, combined with hygiene controls the disease. Illustrations are given of the conditions seen.

CITRUS AND SUB-TROPICALS.

559. SOUTH AFRICA, UNION OF. 634.3 : 382.6
Fruit Production in the Union. Report No. 22. The 1937 citrus export season.

Bull. Dep. Agric. S. Afr. 194, 1938, pp. 47.

These are statistical data of citrus fruit exports compiled by the Chief Government Fruit Inspector at Capetown.

560. ZALDASTANISHVILI, S. G. 634.3 : 581.084.2
On the methods used in citrus plant experiments. [Russian, English summary
 14 lines.]

Soviet Subtropics, 1938, No. 12 (52), pp. 17-20.

A successful experiment was made at the Batum Botanical Gardens to eliminate genetic and ecological factors in the propagation of citrus plant material. This was done (1) by selection of *Poncirus trifoliata* seedlings on the basis of the polyembryonic nature of trifoliata, and (2) by raising *P. trifoliata* rootstocks from cuttings with the aid of heteroauxin (100% rooting). The seeds and the cuttings were taken from the same parent. Variability in ecological conditions was controlled during experiments by the use of small field plots arranged horizontally.

561. GANDHI, S. R. 634.3-1.584
A study of the methods of cultivation of fruit trees with special reference to citrus.

Trop. Agriculturist, 1939, 92 : 3-15, bibl. 10.

It is shown from various authorities and from the author's own work that the laterals of citrus and other orchard trees spread far beyond the radius of the crown, and that in India at least closely spaced citrus orchards begin to deteriorate as soon as the space between the trees is covered by the spreading branches and sunlight is denied access to the soil. The author suggests that cover crops improperly used can do more harm than good by root competition especially in dry areas, and by entirely monopolizing the water content in the top 3 inches of soil may hinder the advance of the slow growing laterals of newly planted young trees into the covered space beyond the drip of the crowns. This condition could be prevented without risk of erosion on level ground by gradually withdrawing the cover before the advance of the roots, up to twice the spread of the branches. The uncovered space between the trees should be kept deeply forked, and mulched with clippings from the cover several times yearly. On hill sides temporary crops should be grown during the rains close up to the trunks, being uprooted and left lying a little before the end of the rains. The remainder of the article deals with the principles of manuring, with special reference to Ceylon.

562. ZANOTTI, L. 634.322
The Clementine in Italy.

Hadar, 1938, 11 : 296-8.

A lengthy botanical description of the Clementine orange, a cross between the common mandarin and the Chinese bitter orange, first made in 1895. The fruit is now widely grown in Mediterranean countries and to some extent in U.S.A. The usual rootstock is the sour orange, but there is evidence that the trifoliolate orange (*Poncirus trifoliata*) is to be preferred.

563. BODENHEIMER, F. S. 634.3-2.7
Citrus-cultivation and citrus entomology in Malta.

Hadar, 1938, 11 : 290-4, bibl. 3.

A short account of the conditions under which citrus is grown in Malta with notes on the more serious insect pests associated with its cultivation.

564. KAHAWITA, R. 634.3-1.67
Citrus culture in the dry zone. Duty of water and irrigation practice. I and II.
Trop. Agriculturist, 1938, 91 : 266-79.

The principles of irrigation for citrus are discussed in Part I with special reference to Minneriya, Ceylon, where the Agricultural Department is starting a large scale experiment to demonstrate the practicability of citrus culture in the dry zone. Part II describes the preparation of the land and the making of inexpensive structures and implements necessary for the field distribution of water in a large plantation. A number of working drawings accompany the article and should prove very useful.

565. ASKEW, H. L. 634.3-1.547.6
Grove conditions and practices in relation to the maturity of citrus fruits.
Proc. Fla. St. hort. Soc. for 1938, pp. 151-5.
 STEWART, C. E.
Maturity in citrus fruits.
Ibidem, pp. 155-8.
 TAYLOR, J. J.
Citrus fruit maturity.
Ibidem, pp. 159-61.

In the first two of these articles growers discuss the factors affecting maturity and of the present tests and standards. In the third the State chemist discusses the effects of present legislation and urges the necessity for growing a better quality of early orange and for chemical investigations into the why and wherefore of maturity in any given fruit.

566. RICHARDS, A. V. 634.3-1.541.11
Studies on stock-seion interaction in citrus. I. Growth and development of seedling stocks and young grafts.
Trop. Agriculturist, 1938, 91 : 12-24, bibl. 10.

The experiment discussed was laid down at Peradeniya in November 1936 with a view to testing the relative merits of sour orange, rough lemon, pummelo (*C. maxima* Merr.) and sweet orange hybrid as stocks for grapefruit, and to compare the performance of Marsh Seedless, Walters, Foster and Triumph grapefruit worked on these stocks, on a basis of growth and habit, yield and quality of fruit, resistance to pests and disease. The stocks are described, particularly with reference to their recognition in the seed bed, and some horticultural notes are given about each. The buddings on all stocks were successful, any failures being due to faulty manipulation rather than incompatibility. Some of the buds on the pummelo stock had to be forced into growth by means of a top dressing of sulphate of ammonia. In subsequent growth all grapefruit varieties on rough lemon have developed vigorously and uniformly; on sour orange they are normal but less vigorous than on rough lemon; on pummelo and, to a limited extent, on the sweet orange hybrid which probably contains pummelo blood—Foster especially, as well as Triumph and Marsh have exhibited very poor and chlorotic growth. Walters, however, although closely allied to Foster, has grown well and apparently normally. Both the pummelo stock and the scion above mentioned grow freely on their own roots without any symptoms of chlorosis. Possible reasons for this drawn from recent literature are discussed.

567. FROST, H. B. 634.3 : 581.141
Nucellar embryony and juvenile character in clonal varieties of citrus.
J. Hered., 1938, 29 : 423-32, bibl. 26.

The tendency to thorniness exhibited by genetic and nucellar seedlings of most genetic types of citrus declines with extension growth in seedlings and their clones, but little, if at all, in the

trunks of seedlings. Different grades of thorniness in the same young nucellar-seedling clone tend to be propagable by budding. Reproduction of an old seedling clone by nucellar embryony regularly produces a more vegetative condition with more vigorous growth and less tendency to flowering. This rejuvenated condition lasts for many years, usually long outlasting seedling thorniness. With the decline of thorniness the tendency to flower production and fruit setting increases. These and other visible changes, which characteristically occur with increase of clonal age, are of the same general nature as those which occur from youth to maturity. The changes with age and the reverse changes in seed reproduction are not genetic. Seedling thorniness, like rapid growth, is probably a manifestation of a more vegetative condition which is produced to about the same average extent in gametic and nucellar seedlings. The decline of seedling thorniness is associated with repeated cell divisions rather than with age *per se*. Fundamentally, regularly occurring age changes are temporary but persistent modifications of the meristematic cells, which are propagated in ordinary somatic division but erased in seed formation. The mechanisms which might bring about such changes are discussed. [From author's summary.]

568. ARGLES, G. K.

634.337-1.541.11

The selection and propagation of limes.*J. Jamaica agric. Soc.*, 1938, 42 : 471-8.

There is much variation among the limes (*Citrus aurantifolia*) of Jamaica due largely to their seedling origin. The methods to be used in the establishment of uniform plantations are discussed. The characteristics on which selection is based are large fruit of good quality, roundish in shape, with thin, smooth skin, plenty of juice of good flavour, few seeds and fruit of a rich deep green colour, freedom from disease, few or no spines. Propagation can be effected by seed, budding or hardwood cuttings. *Seed*. On germination the seed beds must be carefully rogued to eliminate the sexually produced seedlings from those of vegetative origin and roguing of all that differ from the majority must be continued until the final planting out. The numbers removed may amount to 25% of the original stand. *Budding*. There is a discussion as to the most suitable stock on which to bud limes, but the recommendations made are all negative, e.g. growers are advised to discontinue budding lime on sour orange until further information is available some years hence, on the ground that many of the lemon trees in California budded on sour orange collapsed after 20 years of productive bearing, and that the lime is botanically closely allied to the lemon. The sour orange/lime combination is also said to have a tendency to snap off during high winds. [In Dominica this combination is considerably more wind resistant than seedling limes and stands up to hurricanes and the root diseases which devastate the seedling lime plantations ; furthermore it produces heavier crops with a higher acid content, and its use is said to have saved the lime industry. See Annual Reports of Dominica Agricultural Department from 1929.—ED.] Caution is also advised with other stocks because of lack of information based on experiment. Budding on lime presents no difficulty but has no advantage over plants grown from cuttings. Limes are being experimentally raised with success from semi-hardwood cuttings in frames with well-fitting glass or windowlite covers, placed in full sun but shaded with cheesecloth to prevent scorching. The leaves are not removed. Twice daily waterings are given. The best medium is a fine sand with light admixture of leaf mould or soil in the proportion of 4 sand to 1 leaf mould.

569. MARLOTH, R. H.

634.3-1.541.11

The citrus rootstock problem. Citrus tree propagation.*Fmg S. Afr.*, 1938, 13 : 226-31, bibl. 19.

The author has assembled a great deal of information on the subject of rootstocks for citrus, with the object of drawing the attention of nurserymen and growers to its complications. As far as South Africa is concerned it is still impossible to come to any definite conclusion as to the most suitable stock for the country, though the question is being closely studied.

570. ALEXANDROV, A. D. 634.3-1.55
Flower shedding and fruit drop in citrus. [Russian, English summary 29 lines.]

Soviet Subtropics, 1939, No. 4 (56), pp. 60-8.

Under the Caucasus and Black Sea Coast conditions citrus fruit drop has been found to be mainly due to high air temperatures. Flower-shedding is on the other hand attributed to a number of factors, namely biological characteristics of certain varieties and clones, climatic conditions during the flowering period, incompatibility of stock and scion, lack and excess of nitrogenous manuring, damage done to trees by pests and diseases, aridity of soil and air, lack of warmth in the soil in spring, faulty pruning and inadequate soil cultivation.

571. HERRERO, M., AND ACERETE, A. 634.31-1.8 : 581.192
 Análisis de elementos nutritivos en el fruto, la flor y el tallo del naranjo.
 (The analysis of nutrient elements in orange fruits, flowers and shoots.)
Bol. Inst. Invest. Agron. Madr., 1937, 3 : 107-93, bibl. 3.

Analyses of all the citrus varieties examined showed that the shoots contained more P in spring than at any later period, and in the Valencia variety they also contained more Ca. The exact opposite was the case with K. Mandarin flowers contain larger amounts of P, N, K and Ca than flowers of any orange variety. At the time of flowering every tree requires a readily available supply of some 150 g. N and an equal amount of K in order to be able to form 7½ kg. dry substance contained in the 74,000 flowers which—roughly estimated—are produced by every tree. In early buds the total N content per tree is higher than at harvest time or during flowering. The same holds good for P and Ca, to an even more marked degree. K is present in buds at the time of flowering and harvesting in the same or larger amounts than in the spring. Soil conditions and manurial practices used in Spanish orange groves are discussed, certain manurial trials being noted. [From authors' summary.]

572. ANDERSSSEN, F. G. 634.3 : 581.192
Nitrogen and phosphorus in oranges.
Eng S. Afr., 1938, 13 : 349-52, 376, bibl. 4.

The nitrogen and phosphorus content and the nitrogen/phosphorus ratio of orange juice and their relation to the size of crop are studied. The theory is proposed that highest yields of fruit in Navel oranges are accompanied by an optimum content of N and P in the juice. In the orchard under examination the optimum N/P ratio was approximately 9. If lower, the trees have had insufficient nitrogen, if higher, phosphorus appears to be the limiting factor. It is of course also possible that while the N/P ratio is balanced the total amount of the two elements might be insufficient for the best results. Samples of fruit from a number of Navel and Valencia orchards throughout S. Africa and Rhodesia showed statistically a significant relationship between the N/P ratio of any sample of Navel juice and the yield of the tree. The trend for Valencias was similar but not significant. The matter is now being investigated by means of manurial experiments involving a wide range of N and P applications. It is hoped eventually to reach a stage whereby the main fertilizer requirements of N and P for any particular orchard may be determined by an analysis of the juice of its fruits.

573. URUSHADZE, D. R. 634.3-2.111
Over-wintering citrus seedlings. [Russian, English summary 14 lines.]
Soviet Subtropics, 1939, No. 1 (53), pp. 40-2.

In 1936-8 experiments were carried out at the Beria state farm (Ajaria) with one-year-old orange, lemon and mandarin seedlings in order to find the best way of protecting them in winter. 25,000 seedlings were transferred (25 seedlings to a block of soil on each occasion) to sheds on 15 November, 25,000 were sheltered and covered with hay in November, and 1,500 were left in the ground unsheltered. The minimum temperatures were in the open —7° C., in the sheds —1° C. and in the beds under cover —2° C. The best results were obtained with plants that had been sheltered and covered with hay without uprooting.

574. MOROZ, E. S. 634.3-2.111
Determination of the frost resistance of citrus plants by direct method. [Russian
 English summary 14 lines.]
Soviet Subtropics, 1939, No. 1 (53), pp. 34-7.

The present laboratory trials partly confirm the usefulness of the method described in full by the author in a previous number (*Ibidem*, 1938, No. 10 (50), pp. 24-7; *H.A.*, 9 : 204). It was found in the course of these investigations that the degree of hardiness in citrus plants is seasonally variable, i.e. given the same minimum temperature the plants are apt to become more severely injured at the beginning of the winter than in mid-winter or at the end of winter. The hardest and the least frost-resistant varieties of the lemons, oranges, grapefruit and mandarins studied are named.

575. CAMP, A. F. 634.3-2.19
Symptomatology of deficiencies and toxicities of citrus.
Proc. Fla St. hort. Soc. for 1938, pp. 145-50.

The author describes the phenomena as affecting leaves, growth and fruit which may be seen in citrus affected by certain mineral deficiencies or excesses as follows :—zinc deficiency or frencing, copper deficiency or dieback and ammoniation (exanthema of Fawcett), magnesium deficiency or bronzing, boron toxicity.

576. FUDGE, B. R. 634.323-1.811.8
Magnesium deficiency in relation to yield and chemical composition of seedy and commercially seedless varieties of grapefruit.
Proc. Fla St. hort. Soc. for 1938, pp. 34-43, bibl. 2.

Analyses show that fruit of seedy varieties, even after the exclusion of the seed, still contain greater quantities of the elements P, K, Ca, Mg, Fe, Al, and Mn than does the fruit of Marsh Seedless. This indicates that the food value of the former is greater. Although the amount of Mg removed in fruit is comparatively small compared with that of N, K and Ca, being about the same as P, it is thought that it may well be the "limiting element" where the soil supply is low and none is added in the fertilizers. Further examination tends to show by symptoms observed and by comparison with Marsh Seedless that the shortage of magnesium is the cause of leaf bronzing in seedy varieties.

577. TAYLOR, A. LL., AND WITTE, P. J. 634.31 : 581.192
Carotene in oranges.
Industr. Engng Chem. (Industrial edition), 1938, 30 : 110-1, bibl. 10.

Based on a sample of 24 oranges and counting carotene as the total carotinoid pigments extracted, carotene was found in oranges from different sources as follows :—1. From California, Valencias (14 samples) 1.65 mg. per litre, Washington Navels (68 samples) 1.07 mg. per litre ; 2. From Florida, Valencias (34 samples) 0.57 mg. per litre, pineapple orange (32 samples) 0.34 mg. per litre, and assorted oranges (16 samples) 0.32 mg. per litre.

578. RYGG, G. L., AND HARVEY, E. M. 634.323 : 581.192 : 664.85.323
Behaviour of pectic substances and naringin in grapefruit in the field and in storage.
Plant Physiol., 1938, 13 : 571-86, bibl. 8.

The effects of season and storage temperature on pitting in Marsh grapefruit and certain chemical changes in the fruit rind have been observed in California. Storage temperatures used were 38°, 46° and 56° F. Pitting was worst at 38° and least at 56° F. In most cases severity of pitting varied directly with the mean temperature of the five days preceding picking. Respiration of the fruit in sealed chambers was measured by the duration of the period of negative pressure. There was a direct relation between the length of this period and susceptibility to pitting. Soluble pectin in the albedo increased during the season. Changes in protopectin did not follow a seasonal trend, but there was a tendency for the minimum to occur at

mid-season. Storage for 6 weeks did not alter the quantitative relationship between the soluble pectin and protopectin. Naringin in the albedo of grapefruit from the field varied in much the same way as the total pectic substances. It usually increased during storage, the increase being greatest at the higher temperatures.

579. RHOADS, A. S. 634.3-2.4 + 2.8
Limitations of the bark-scraping method in the control of gummosis and psorosis of citrus.

Proc. Fla. St. hort. Soc. for 1938, pp. 114-27, bibl. 3.

Careful observations over some 10 years in grapefruit, orange and tangerine groves shows that bark scraping has proved effective in most cases for the cure of psorosis in orange trees and both psorosis and gummosis in grapefruit trees, provided the work has been thoroughly done in the early stages of the development of these troubles. Once they have become systemic and have killed the bark to the wood, which then becomes invaded by various organisms, the treatment may possibly prolong life somewhat but cannot save the trees.

580. KUNTZ, W. A., AND RUEHLE, G. D. 634.3-2.4
Spraying and pruning for melanose control.

Proc. Fla. St. hort. Soc. for 1938, pp. 89-102, bibl. 7.

Data from 4 years' field experiments of spraying and pruning to control melanose are tabulated here. They lead to the following conclusions. Melanose cannot under Florida commercial conditions be entirely eliminated and the causal organism will always be present. Three features, namely cold injury, cropping strain and severe scale infestations tend to increase its incidence by increasing the dead wood, and their effects should, so far as is possible, be eliminated by judicious pruning. In general, if bright fruit is wanted, spraying must be emphasized especially in older groves. If severe shocks have been experienced by the trees and the objective is not necessarily bright fruit, control by pruning must be emphasized. A combination of pruning and spraying will afford the best control, the balance of the application of these two depending on personal observation and requirements.

581. BAKER, R. E. D. 634.323-2.95
The control of scab and certain other diseases and pests of grapefruit by fungicides and insecticides.

Trop. Agriculture, Trin., 1939, 16 : 31-4, bibl. 4.

Instructions are given for the control by spraying (lime sulphur and/or bordeaux) of the various pests and diseases which attack grapefruit in Trinidad. Types of spraying machinery suitable for the conditions in the island are suggested from the experiences of other citrus producing countries.

582. BEN-AMOTZ, Y. 634.3-2.95
The various methods of citrus spraying and their properties.

Hadar, 1938, 11 : 211-3, 217, bibl. 9.

A brief review of the various methods of spraying citrus, their advantages and disadvantages, compiled mainly from Californian sources and studied here with special reference to their applicability to Palestine conditions.

583. SPENCER, H., AND OSBURN, M. R. 634.3-2.7
Citrus insect projects of the Orlando laboratory.

J. econ. Ent., 1938, 31 : 728-30, bibl. 1.

Projects discussed concern the citrus rust mite (*Phyllocoptes oleivorus* Ashm.), adhesives for wettable sulphur, sulphur dusting, recent increased infestations of scale insects and white flies, rapid methods of determining infestations, scale control with lime sulphur and oil emulsion sprays, the Florida red scale (*Chrysomphalus tonidum* L.), fruit fly bait sprays and miscellaneous.

584. THOMPSON, W. L. 634.3-2.752
Results of different methods of oil application for the control of scale insects on citrus.

Proc. Fla. St. hort. Soc. for 1938, pp. 109-14.

A comparison of varying success achieved in scale control by the use of different apparatus in different ways.

585. KIRTBAYA, Yu. K. 634.3-2.944
Mechanized citrus fumigation. [Russian, English summary 12 lines.]
Soviet Subtropics, 1939, Nos. 2-3 (54-55), pp. 31-41.

On account of its better performance and increased killing power as compared with the ordinary pot fumigation method an orchard fumigator, devised by the Sukhum Branch of the U.S.S.R. Institute for Tea and Subtropical Cultures, is regarded as particularly useful for Soviet subtropics. The apparatus consists of two tanks to hold sulphuric acid and cyanide, a device for controlling the dosage, a three-gear combined crane and a reaction chamber. All the parts are mounted to a one-piece welded cart which is transportable on a single pneumatic tyre.

586. OSBURN, M. R., AND SPENCER, H. 634.3-2.752
Effect of spray residues on scale insect populations.
J. econ. Ent., 1938, 31 : 731-2.

The use in the control of scale insects of adhesive materials liable to leave heavy, inert residues should be avoided in view of the increases in scale population likely to result.

587. TILLSON, A. H., AND BAMFORD, R. 587.519 : 581.46
The floral anatomy of the *Aurantioideae*.
Amer. J. Bot., 1938, 25 : 780-93, bibl. 19.

588. TRAUB, H. P., AND ROBINSON, T. R. 634.1/8
Improvement of subtropical fruits other than citrus.
 Noted in but omitted from *Yearb. U.S. Dep. Agric.* 1937, issued as *Yearb. Separate* 1589, pp. 1-77, bibl. 137.

The fruits discussed at length are fig, avocado, date, pineapple, papaya and mango ; there are shorter notices of olive, persimmon, granadilla, guava, feijoa, jaboticaba (*Myrciaria cauliflora* Berg. Brazil), pomegranate, jujube, lychee, loquat, white sapote (*Casimiroa edulis* Llave and Lex, Mexico) and cherimoya. The fuller sections begin with historical notes which recount the circumstances of introduction and subsequent progress in U.S.A. of each variety, after which the present work on breeding both at home and abroad is briefly reviewed and the available cytological and genetic data are discussed. Much information on the technique to be used in breeding is given for each variety and the ideals to be aimed at are stated. The less important fruits are dealt with more briefly and technical information on breeding is usually omitted. There is an appendix giving the chromosome numbers of some of the plants discussed.

589. TARANOVSKAYA, V. G. 631.4
Improving the red soils. [Russian, English summary 16 lines.]
Soviet Subtropics, 1939, Nos. 2-3 (54-55), pp. 19-30.

Trials carried out for some time at Sochi, Sukhum and Chakva showed that citrus, tung and other subtropical plants produced higher yields and better quality fruits on red soils when these were treated with silicates. Silicates had also the useful effect on green crop manures of shortening their vegetative period. It was found to be less profitable to apply silicates to soils under tea.

590. WALTER, E. V., SEATON, L., AND MATHEWSON, A. A. 632.796
The Texas leaf-cutting ant and its control.
Circ. U.S. Dep. Agric., 494, 1938, pp. 18, bibl. 13.

The life history and habits are described of *Atta texana*, a fungus-growing ant found in Texas, Louisiana and certain other areas, where it causes serious yearly losses of cereals, forage, orchard and truck crops. Carbon disulphide was most effective both as a fungicide and insecticide, particularly when the nests were treated with it from late February to early April (Texas conditions).

591. REID, W. D. 588.427 : 632.3
Grease-spot of passion fruit.
N.Z. J. Sci. Tech. (Agric. Sect.), 1938, 20 : 260A-5A, bibl. 4.

A bacterial disease of passion fruit has caused severe loss in New Zealand. Symptoms are the appearance of water-soaked areas on the fruits, brown spots surrounded by lighter halos on leaves, water-soaked depressed areas on twigs and stems and brown cracked lesions on the older wood. The organism has been named *Phytomonas Passiflorae* n.sp. As far as can be discovered the disease seems to be spread by workers during operations requiring handling of the vines and to carry over from season to season. Control measures suggested are :—spray periodically with bordeaux 3-4-50 from the time the first leaf spots appear ; prune all dead tissues and thin out the shoots of healthy vines and train over wires to permit penetration of the spray ; burn all prunings and other debris from the plant ; destroy heavily infected vines.

592. TAGI-ZADE, A. 634.63 : 581.142
Accelerating germination in olive seeds. [Russian, English summary 14 lines.]
Soviet Subtropics, 1938, No. 3 (43), pp. 71-3.

Trials were made for several years at the Azerbaijan Experiment Station for Dry Subtropics in an attempt to speed up olive seed germination. Both thermal and chemical stimulation were used. Studies were also made of the germination capacity and the rate of germination of seed at different stages in biological maturity. The following chemical stimulants were tried :—tannin, acetone, ether, chloroform, hydrochloric and sulphuric acids and various alkalis, but positive results were only obtained with caustic soda. The soaking of the seed in 12% caustic soda solution for 14-16 hours resulted in seedling growth taking place in 60-80% of the seeds in 75-90 days after planting, while seed exposed to a temperature of 50° C. for 24 hours and left in the dark only germinated 105 days after planting. There are indications that rapid germination may best be secured by harvesting and planting the seed before it has reached commercial maturity, as in this case the growth starts early (on the 40th-50th day). Planting should be done immediately after the harvest.

593. BRANDONISIO, V. 634.63 : 551.56 : 665.327.3
Resa e qualità dell'olio in rapporto all'andamento stagionale. (Yield and quality of olive oil as affected by season.)
Memoria Staz. agrar. sper. Bari 29, 1938, pp. 64, bibl. 193 (being *Pubblicazione* 194).

The author finds that not only weather conditions but also severity of infestation by the olive fly have important effects on the times at which olives reach their greatest weight, and contain the most oil. There are also considerable differences between the behaviour of different varieties in these respects. Results of several years' observations are here set out and discussed.

594. FROLOV, T. V. 633.91
Guayule cultivation in U.S.S.R. [Russian.]
Soviet Subtropics, 1939, Nos. 2-3 (54-55), pp. 77-81.

Detailed and illustrated descriptions are here given of two broad-leaf and two narrow-leaf guayule varieties grown commercially in U.S.S.R. All four varieties have been obtained by selection from Mexican strains at the Morgushevan Research Station.

595. SIVORAKSHA, G. S. 634.574
Wild pistachio trees in Baba-Tag mountains. [Russian.]
Soviet Subtropics, 1939, Nos. 2-3 (54-55), pp. 84-5.

An account is here given of age, shape, root and growth habit and certain other characteristics of wild pistachio trees growing in Baba-Tag Mountains, Uzbekistan.

596. TROS'KO, I. 634.574
Central-Asiatic pistachio forms. [Russian.]
Soviet Subtropics, 1938, No. 12 (52), pp. 28-31.

Among wild Uzbek pistachio trees in 1937 and 1938, 18 forms of *Pistacia vera* L., which produce particularly large nuts containing high amounts of fats, have been found by the Baba-Tag Branch of the Uzbek forest research station. Soil and climatic conditions prevailing in Baba-Tag Mountains are discussed.

597. ШУКХИН, М. 634.574-1.541
Scion-grafting wild pistachio trees. [Russian.]
Soviet Subtropics, 1938, No. 12 (52), pp. 32-3.

Trials carried out for 2 years at the Nikita Botanical Garden showed that under sub-tropical conditions April is the best time for grafting pistachios, that a higher take was obtained from rind-grafting than from any other method used and that preliminary treatments of stock and scion with sulphuric acid, sugar and alcohol in order to prevent gumming gave negative results.

598. ANON. 634.462-2.3/4 + 2.6/7
Pests and diseases of the carob tree.
Cyprus agric. J., 1938, 33 : 27-8, bibl. 5.

The more important pests and diseases of the carob tree are briefly noted. These are white scale (*Aspidiotus hederae* Vallot) controlled, if accessible, by spraying with white oil emulsion. Badly infested trees are cut back before spraying. Carob moth (*Myelois ceratoniae* Zell.). The larvae attack the pods on the tree and in storage. Attacked pods exude a sticky juice which falls on to the leaves and twigs below. Cleanliness in stores and the separation of attacked pods afford some slight control. Fumigation is effective where possible. Boring beetles (especially *Cerambyx velutinus* Brull.) tunnel the trunk and branches and may kill the tree. Control measures consist in pushing a wire into the holes, which are detectable by the frass at the entrance, or plugging the hole with paradichlorobenzene and sealing with clay or wax. Carob midge (*Asphondylia gennadii* March) causes stunting of young pods, due to the presence of larvae. There are no effective control measures but destruction of dwarfed and misshapen pods before the adults emerge in April-June would reduce the next attack. There are no diseases sufficiently serious to affect the crop. A fungus, *Cercospora Ceratoniae* Sacc., causes leaf spotting and mildew, *Oidium Ceratoniae* Ames, sometimes deforms young pods. Wound parasites do some damage to the wood.

599. HALMA, F. F., AND EGGERS, E. R. 634.653 : 581.44
A promising method for distinguishing between Mexican and Guatemalan avocado bark.
Yearb. Calif. Avocado Assoc. for 1938, pp. 107-8.

Mexican and Guatemalan avocados can be distinguished from each other in the absence of leaves (as in rootstocks) by adding water to the powdered bark. Mexican bark so treated forms a viscous mass while Guatemalan remains more or less granular. The behaviour of the hybrids approaches more nearly to that of the Mexican. The technique for preparing the bark is described.

600. HODGSON, R. W., AND EGGERS, E. R. 634.653-1.537
Correlations between size of seed, seedling and nursery tree in the avocado.
Yearb. Calif. Avocado Assoc. for 1938, pp. 92-6, bibl. 10.

From correlation studies on a progeny of 772 avocado seedlings which gave rise to 629 budlings it was concluded :—The size of the seedling is positively correlated with the size of the seed. When budded the larger seedlings produce the larger budlings provided the time of bud start is the same. Newly budded plants which start in the autumn are more uniform than those that start in the spring.

601. CALVINO, E. M. 634.653 : 581.145.1 : 581.162.3
Biologia florale della Persea drymifolia. (**Floral biology of avocado grown at San Remo.**)
Pubbl. Staz. sper. Floricoltura O. Raimondo, Sanremo 31, 1938, pp. 11, bibl. 9.

It is found that dichogamy cannot be considered the only cause of irregular fruiting of the avocado (*Persea drymifolia*) at San Remo for the following reasons. (1) The dichogamy is not universal as has been discovered by studying the floral cycle of more than 300 flowers. (2) Isolated specimens have fruited a few years after planting whereas specimens planted in pairs, one of which shows morning and the other evening anthesis, are not fruiting or at least only one of them. The cause of irregular fruiting at San Remo is the wind and the dryness of the air which hinder setting. In certain sheltered spots at San Remo the avocado manages to produce fruit and in such cases it fruits more freely on the side least exposed to the wind. Conditions favourable to fruit production are proximity to buildings or of olive or other trees to the crown of the avocado tree and in some cases of open tanks. Spraying the top of some specimens during the heat of the day in April and May has resulted in abundant fruit production by one specimen which normally fruits badly and the setting of a certain number of fruits on specimens which have previously borne nothing and were much exposed to the sun. The morphology and biology of the flower of *P. drymifolia*, which is insect pollinated, are also being examined and the pollen of *Persea* spp. grown in the tropics in Cuba is being compared with that produced by the local varieties. Observations are also being made on the second flowering in the autumn and on flower fall.

602. PARKER, E. R. 634.653-1.8
The question of avocado fertilization.
Yearb. Calif. Avocado Assoc. for 1938, pp. 119-24, bibl. 3.

In this paper only general principles of manuring with special reference to Californian soils are discussed, since little is known about the special nutritional requirements, if any, of the avocado.

603. MILLER, J. C. 634.653-2.111
Rehabilitation of frost damaged trees.
Yearb. Calif. Avocado Assoc. for 1938, pp. 86-9.

It is assumed that frost damage resembles that of a severe pruning accompanied by soil moisture complicating factors. Replacements should not be made unless the tree is moribund, since the recovery of a frozen tree and its return to bearing far surpasses the possibilities of a newly planted tree. Pruning should be deferred until a year after growth has restarted. It will then be possible to distinguish the dead wood with certainty and to remove it. Trunks should be sprayed with whitewash in the event of another period of frost; this will check sunburn and need only be done on the south, south-east and south-west sides of the tree. Manuring should continue as in a normal season. Irrigation should be done as required and for this the use of a soil auger is essential, both before and after irrigation. Good drainage, especially if the subsoil is at all heavy, is essential; especially in badly drained soil root damage is likely to occur with trees already defoliated by frost. Removal of sucker growth from damaged trees was unnecessary as the surplus twigs soon became crowded out when recovery took place.

If hardier and better marketable varieties than the damaged trees are available for scion wood, frost damage offers an opportunity for topworking. New growth from damaged trees should be trained to the single trunk central leader form. Finally emphasis is laid on the uselessness of trying to grow the avocado for profit in any but a really suitable environment.

604. IVASHCHENKO, A. I. 633.86.11.871-1.535

Propagating *Eucalyptus* by cuttings. [Russian.]

Soviet Subtropics, 1939, No. 4 (56), pp. 83-4.

In 1938 a branch of the Institute of Tea Production in U.S.S.R. succeeded in propagating *Eucalyptus* by means of cuttings for the first time. The cuttings were taken in the spring from seven-months-old seedlings and were 5-6 cm. long and had 5-7 leaves. After the removal of a portion of the lower leaves they were planted in sand at a depth of 1.5 cm. Excessive watering was avoided. The air temperature in the nursery was 20° C. to 22° C. during the day and about 8° C. at night. They started to root at the beginning of May. When the rooting was complete they were transplanted to pots. The whole process took some 50 days. *Eucalyptus urnigera* Hook gave 20%, *E. tereticornis* Sm. 40%, *E. cinerea* F.M. 4% and *E. rudis* Endl. 38% rooting.

605. CHULKIN, V. 633.812

Essential oil plants for the agricultural exhibition in Moscow. [Russian.]

Soviet Subtropics, 1939, Nos. 2-3 (54-55), pp. 42-8.

The agricultural exhibition in Moscow has been postponed till 1 August, 1939. Since most of the exhibits had already arrived at the exhibition grounds some time ago, problems arose concerning the care of the plants over a prolonged period. In the present article some of the essential oil plants are described, notes being given on the treatment they have received since their arrival at the exhibition grounds.

606. LARINA, A. K. 633.85

Experiments in the propagation of *Eucalyptus citriodora*. [Russian, English summary 7 lines.]

Soviet Subtropics, 1939, Nos. 2-3 (54-55), pp. 51-3.

Experiments conducted by the author in 1937 showed that *Eucalyptus citriodora* plants may, in addition to being raised from seed, be grown from cuttings. Changes in the growth of cuttings and seedlings were produced by various exposures to light. The leaves of plants under long exposure to daylight had greater oil content, were much longer and of a brighter green than those of short-day or normally exposed plants.

607. TRUSHINSKY, G. M. 633.812

Machinery for planting geranium. [Russian.]

Soviet Subtropics, 1939, No. 4 (56), pp. 78-80.

A Russian machine originally designed for planting tobacco proved useful for planting geranium.

608. MASLENNIKOV, A. V. 633.812-1.8

Fertilizers for geranium. [Russian.]

Soviet Subtropics, 1939, Nos. 2-3 (54-55), pp. 61-2.

Pot trials with geranium (*Pelargonium Radula*) showed that in podzol soils of the humid subtropics geranium responds extremely well to nitrogenous fertilizers, while potash and phosphorus (without nitrogen) has but little manurial effect. Of the phosphates tried Thomas (basic) slag gave the best results.

TROPICAL CROPS.

609. KUNTZE, H. A. 016 : 551.566.1 : 633/5-2.1/8
 Literatur über tropische Nutzpflanzen und deren Krankheiten und Schädlinge.
 (**Literature on economic plants of the tropics and their pests and diseases.**)
Mitt. biol. Reichsanst. Berl., 1938, Heft 56, pp. 32.

In the first part books dealing generally with tropical agriculture including pests and diseases, horticulture and various subjects such as manuring, etc., are listed.

The second part deals with books on particular economic plants according as they produce one of the following commodities :—starch, sugar, oil, stimulants, fibre, rubber, edible fruits—namely citrus, banana, pineapple and mango—, timber and various. A certain number of references are also made to floras compiled in different parts of the world, and finally 18 periodicals are listed, the contents of which refer wholly or in part to tropical crops. A surprisingly large number of German books are listed, most of them having been published in the last ten years.

610. BECKLEY, V. A., GRADING, C. B., AND IRELAND, F. 589.98 : 632.951.1
Pyrethrum flowers. Kenya, a better source.

Industr. Engng Chem. (Industrial edition), 1938, 30 : 835-8, bibl. 5.

Pyrethrum was introduced into Kenya in 1928. As the result of experimental and commercial work its cultivation has greatly increased and in 1936-7 the acreage planted had risen to 4,624, the tons produced to 1,042 and tons exported to 976. It is confined to a few districts lying between 6,500 and 9,500 ft. above sea level. Propagation is by offsets or "splits" and the plant shows no sign of suffering from the process. Spacing varies from 15 × 15 in. to 24 × 30 in., a common one being 18 × 18 in. The more subject the land is to weed growth, the wider is the spacing. Good drainage is essential or there is liability to trouble from fungus diseases. No manuring has yet been found necessary. Subdivided plants are generally in full bloom 4 months from planting. There is then continuous blooming which necessitates hand picking of the flowers. These are not picked till they have at least 2 rows of disc florets open. Flowers are dried in an Ainabkoi dryer. The dried flowers are poured into Kraft paper bags which hold about 50 lbs. and are sealed with a paper cover pasted over the top. The bags are sent to Nakuru where the material is carefully graded so as to contain not more than 33% immature flowers or 10% discoloured flowers and to be free from foreign matter. The approved product is then mixed, baled and again sampled for the guarantee. Analyses show that in transit to Minneapolis, U.S.A., in 1936, there was an average loss of 1.4% in moisture and of 6.3% in pyrethrin content. The average pyrethrin content at Minneapolis in 1936 was found to be 1.54% on the dry basis or 1.42% in flowers containing 8% moisture, which compared favourably with the 1.38% pyrethrin content of pyrethrum from Japan during the same period. A tentative price standard based on these figures in 1937 considerably helped Kenya producers.

611. ANON. 632.951
The cultivation of *Lonchocarpus*.

Bull. imp. Inst., Lond., 1938, 36 : 179-85, bibl. 10.

This is a compilation from the scanty literature available on the cultivation of various species of *Lonchocarpus*, rivals of *Derris* as rotenone-containing plants. Briefly the conditions for success seem to be an even tropical climate, a rainfall of 80 inches or more, light shade in the nursery stage and open ground cultivation later, sandy soil for *L. Nicou*, black soil with humus for *L. Urucu*. Propagation is by stem cuttings taken from near the base, bearing 2 or 3 nodes, planted at an angle of 45° with one node above the surface and 3 feet between plants. Growth in Peru is to 3 ft. by the end of the first year, 5-6 ft. at 2 years and 8 ft. at 3 years. Harvesting of the roots takes place at the end of the 2nd, 3rd or 4th year. Weeds are often kept down by inter-cropping with cassava, beans, pineapples, etc.

612. CULPEPPER, C. W., AND MOON, H. H. 633.49
Composition of the rhizome, stem, and leaf of some horticultural forms of *Canna* in relation to their possible use.
Circ. U.S. Dep. Agric., 497, 1938, pp. 22, bibl. 13.

It has been shown that the composition of different parts of *Canna edulis* varies to a very large extent. The variations in composition and yield found to exist in different clones and seedlings of the edible group indicate the possibility of selecting types which are adapted to growth in particular localities and which produce good crops of rhizomes of high starch content. The rhizomes of the ornamental varieties differed in their composition from types of *Canna edulis* in having considerably higher tannin content and a somewhat higher content of total nitrogen, nitrate nitrogen and acids. The fibre content was also higher in the ornamental varieties.

613. MILLER, J. C. 633.492-1.52
Comparative methods and techniques in sweet potato breeding in Louisiana.
Trans. Peninsula hort. Soc. 1938, 1939, pp. 15-8.

Since little information is available on the technique which can most profitably be used for breeding sweet potatoes, this article is very welcome. Among the conclusions reached are the following:—Results show that flowering and seeding habit is a varietal characteristic and each variety has its optimum temperature and day length under which flowering and seeding will occur most freely. In Louisiana most varieties flower best under 11½ hour day conditions in the autumn and under 14 hour day conditions in the spring. Certain varieties bloom best under relatively short-day, others under long-day conditions. Generally a higher percentage of seed is set from spring than from autumn crosses. Again the percentage is higher from crosses made between 8 and 10 a.m. in the autumn and between 6 and 9 a.m. in the spring than from those made at other times. A temperature of 70-75° F. would appear to be ideal for flowering and setting of seed. The actual technique used is described in detail.

614. BRANNON, L. W. 633.492-2.76
The sweet potato leaf beetle.
Circ. U.S. Dep. Agric. 495, 1938, pp. 9, bibl. 5.

The life history and habits are here described of *Typophorus viridicyaneus* Crotch, a beetle attacking sweet potatoes in the Middle and Southern States of U.S.A. and in Illinois. Its control by insecticides and hand picking is discussed.

615. BOSWELL, V. R., BEATTIE, J. H., AND McCOWAN, J. D. 633.492-2.83
Effect of potash on grade, shape, and yield of certain varieties of sweet potatoes grown in South Carolina.
Circ. U.S. Dep. Agric. 498, 1938, pp. 23, bibl. 12.
 BEATTIE, J. H., BOSWELL, V. R., AND McCOWAN, J. D. 633.492-1.532
Sweet potato propagation and transplanting studies.
Circ. U.S. Dep. Agric. 502, 1938, pp. 16.

Results of sweet potato trials carried out in South Carolina are reported in these two papers.

616. CALDWELL, J. S., MOON, H. H., AND CULPEPPER, C. W. 633.492
A comparative study of suitability for drying purposes in forty varieties of the sweet potato.
Circ. U.S. Dep. Agric. 499, 1938, pp. 52, bibl. 51.

A method for the dehydration of the sweet potato has been developed giving a product of attractive appearance, acceptable quality, capable of being prepared for the table in a variety of ways and sufficiently resistant to atmospheric conditions to permit storage and distribution without special precautions against loss. The method consists essentially in careful inspection of the stock to eliminate decayed roots, peeling by abrasive machine or by immersion in hot lye solution of appropriate strength, washing and trimming, slicing or cutting into longitudinal

strips by hand or machine, immersing in dilute citric acid solution to prevent darkening, spreading on trays, exposing to live steam for a sufficient period to cook the material fairly thoroughly, and drying at 130° to 165° F. to a residual moisture content of 12 to 15%. Sweet potatoes may be dried directly from the field as dug or after previous curing and storage; the products made from cured and uncured stock of the same variety will differ considerably in sweetness, depth of colour, and firmness of texture when prepared for the table and will require slightly different treatment in cooking, but will be of like quality. Moreover, all the varieties and strains of the sweet potato obtainable were examined with respect to their suitability for drying purposes and the quality of the dehydrated product made from them. The more promising varieties are named.

617. PAUL, W. R. C., AND FERNANDO, M. 633.71-2.4
Some studies on tobacco diseases in Ceylon. V. The use of fungicides in the control of damping-off of tobacco seedlings.
Trop. Agriculturist, 1938, **91** : 338-44, bibl. 8.

Weekly spraying with colloidal copper compound gave almost complete control of damping-off of tobacco seedlings at the Experiment Station, Ganewatta, Ceylon. Two proprietary products containing salicylanilide and a copper-lime dust respectively were ineffective.

618. MAKAROVA, K. N. 633.72-1.535
Vegetative propagation of tea by cuttings. [Russian, English summary 22 lines.]
Soviet Subtropics, 1939, No. 4 (56), pp. 49-55.

In 1938 experiments were made at Sukhum on propagating tea from cuttings. One-leaf cuttings (3-5 cm. long) taken from one-year-old seedlings in June or July started rooting in the glasshouse on the 15th day after planting, and completed rooting on the 30th day. Two-leaf cuttings (10-12 cm. long) taken from old bushes gave 99.2% rooting on the 73rd day after planting in the glasshouse. Cuttings planted in cold frames gave only 54% rooting. There was a wide range in the length of time required for rooting by individual cuttings. The differences were particularly great in cuttings planted in frames. The mean soil temperature in the glasshouse was 23° C., while the temperature of the air ranged between 27° C. and 28° C. The frames were shut at night.

619. BAKHTADZE, K. E. 633.72
The height of the tea bush and its yield. [Russian, English summary 13 lines.]
Soviet Subtropics, 1938, No. 12 (52), pp. 8-16.

Data, which are tabulated, show that under Ajarian conditions (Chakva) tea leaf yields are determined by (1) the size of the bush (particularly the spread of the crown), (2) the individual ability of the plant to produce shoots, (3) variety, (4) leaf characters, and (5) the flowering capacity. The facts established indicate, the author concludes, that there is plenty of scope for increasing tea leaf production.

620. A.P. 633.72-1.542
Extending the tea pruning period. [Russian, English summary 9 lines.]
Soviet Subtropics, 1938, No. 12 (52), pp. 21-2.

According to recent agricultural regulations (1937-8) tea bushes must be pruned in early spring. The author recommends for the warmer districts in Georgia (U.S.S.R.) a still earlier pruning, i.e. from 1 December to 1 April. Winter pruning is said to be without disadvantages and to have the following advantages:—(1) it prolongs the pruning period and thus helps to mitigate the labour shortage during harvesting and so is conducive to careful pruning; (2) the work can proceed on plantations in the correct order, there being no need for cultivation prior to pruning; (3) finishing the pruning before the growth season starts will stimulate the early growth of flushes and extend the spring growth period by 10-15 days; (4) winter pruning will result in destruction of many pests and diseases.

621. TANGANYIKA TERRITORY, DEPARTMENT OF AGRICULTURE. 633.73
Quarterly notes of the Coffee Research and Experiment Station, Lyamungu,
Moshi, 7, 1938, pp. 12.

Pp. 3-6 contain the speech made on behalf of the Governor at the General Council Meeting of the Tanganyika Coffee Growers' Association. This deals with the future prospects of coffee growing in Tanganyika. The suggestion is made that while the commercial production of standardized high yielding and good quality coffee clones is a certainty in the near future, it is none the less desirable that coffee should cease to be grown as a sole crop, and that, where possible, a system of mixed farming should be introduced with high quality coffee as the mainstay. Pp. 7-9 report progress in vegetative propagation. Cuttings have rooted steadily in the frames in spite of hot dry weather. By watering the outside of the glass lights the temperature within was maintained between 20° C. and 25° C. The relative humidity was maintained at 90 by means of a fine mist spray applied once or twice daily. The method of obtaining cuttings in quantity from selected clones is as follows. The rooted cuttings which are to provide the source of supply are planted out 4 to 5 feet apart in nursery rows and allowed to grow up on the multiple stem system. When sufficient growth has been made the remaining primary branches are removed and each stem is pegged down in a horizontal position. Suckers will then grow up vertically from the dormant buds at each node. These suckers provide the clonal material for cuttings. The top of the stem is retained to draw the sap the full length of the plant and this can be pegged down again later.

622. "PLANTER." 633.73
Quality coffee.
Mon. Bull. Coffee Bd Kenya, 1939, 5 : 34-5.

The author endeavours to account for the difficulty of producing highest quality coffee in Kenya, on older plantations. (a) No essential mineral deficiency has been traced by the soil chemists. (b) None of the estates that produce the highest marks indulges in heavy manuring. (c) While it is probable that serious overcropping may adversely affect the liquor it is certain that small crops on healthy trees do so. The best liquoring coffee comes from the heavy croppers. (d) The best quality coffee is produced on the oldest wood, therefore shoots which are to carry the season's crop should be in existence as early as possible the previous year. None of the estates producing the best quality coffee seems to practise heavy pruning. (e) There are indications that multiple stems produce better coffee than single stem trees. From these and other observations it is concluded that the leaf/crop ratio has a very important influence on the liquoring quality of coffee and that in the case of young coffee up to about 10 years the ratio of crop to foliage is naturally correct and almost constant. After that age, however, owing to the unnatural topping of the tree at 5 feet or so the tendency is for the foliage to increase at a far greater rate than the crop, thus throwing the tree out of balance and producing coffee of poor liquoring quality.

623. R.L.S. 633.73
Notes on coffee production in Indo-China.
Mon. Bull. Coffee Bd Kenya, 1939, 5 : 33-4.

An account of a visit to a coffee estate in Indo-China. The altitude was 3,000 ft. The coffees grown are arabica, Bourbon and a variety of excelsa called Chari. Growth is very rapid, a 14-month-old tree being equal to a good 3-year-old Kenya tree. *Leucaena glauca* is used as shade. Its deep rooting habit removes its roots out of the coffee root area, and as it is a very quick grower the growth of the coffee beneath can be regulated by the degree of thinning of *Leucaena*. Weeds do not flourish under it or under its numerous seedlings which germinate all round it. The coffee is raised from seed in shaded nurseries, the shade being gradually lightened as the seedlings grow.

624. GILLETT, S. 633.73-1.542

When to prune.

Mon. Bull. Coffee Bd Kenya, 1939, 5 : 38.

The pruning of single-stem coffee should be deferred until the flower buds for the next crop are definitely formed. At the end of crop, however, a light handling should be given to ensure a fairly open tree, to assist the season's growth and to render pest control easier. This advice does not concern trees that have overcropped and are in a state of die-back ; these should be left to recover naturally. Nor does it concern trees that, having borne no crop, have produced new wood and early flower buds ; such trees can be pruned or handled earlier and by so doing the pressure of work, which will occur when the delayed pruning takes place, will be somewhat reduced. Multiple-stem trees should also not be pruned until after flower bud formation but the problem is not complicated by the necessity of producing the right type of cropping wood.

625. GETHIN-JONES, G. H. 633.73-1.8

Some reminders on the manuring of coffee.

Mon. Bull. Coffee Bd Kenya, 1939, 5 : 30-2.

Instructions on the proper making of a compost heap are given with a warning against allowing much earth to enter the heap. Phosphatic manures are best applied in the form of bone meal and as in the case of potash should only be given in sufficient quantity to maintain the fertility of the block. It often happens that the amount available in the soil will be enough to enable a yearly application to be avoided. The necessity for keeping manurial records is stressed.

626. GILLETT, S. 633.73-2.952.21

Further investigations on the application of copper sprays to coffee, using a fog sprayer.

Mon. Bull. Coffee Bd Kenya, 1939, 5 : 8-9.

Some recommendations are made based on further field experience, on the methods of using a fog spray on coffee. Suitable formulae for bordeaux and for home made colloidal copper are suggested.

627. GREEN, E. C. 633.74

Cacao cultivation and its application to the Mandated Territory of New Guinea.

New Guinea agric. Gaz., 1938, 4 : 4 : 2-62, bibl. 26.

The article describes fully the most recent methods of cacao cultivation with suggestions for their application to New Guinea where the planting material is excellent and compares favourably with that of Ceylon and Java. The necessity for seed selection is stressed. Cacao can be cultivated in New Guinea in combination with coconuts, the staple crop, but one which has recently been scarcely profitable. The author is, however, not convinced that such interplanting will prove permanently profitable and the period of its success will depend on the existing age of the coconuts at interplanting, the locality and soil origin.

628. MOLEGODE, W. 633.83

Cardamoms. I and II.

Trop. Agriculturist, 1938, 91 : 325-8, 329-32.

I. *Cultivation.* In Ceylon the elevation for the successful cultivation of Malabar cardamoms is between 2,000 and 3,500 feet and for Mysore cardamoms 3,000 to 4,500 feet above sea level, with an annual rainfall of 120-150 inches ; well drained, moist, rich loamy soils, such as are found under high forest, are the most suitable. A light shade and shelter from wind are other requirements. Planting distance is 8 feet apart in previously prepared holes filled with surface soil which has then been allowed a few weeks to settle. The rhizomes which form the planting stock should be 18 months to two years old and contain at least two growing stems. They are set in the soil up to the collar and the soil made firm. Failing rhizomes plants can be grown

from seed sown, for preference, in boxes in a compost of leaf mould and sand. The plants are ready for transplanting to the field when about a year old. Owing to poor and delayed germination 1 lb. of dry seed should be sown to plant one acre. Little other cultural attention is required beyond occasional weeding. Experiments with artificial manures have produced no significant results. The plants begin to bear in two-three years and are in full bearing in the fifth year when a crop of 1,000-1,500 lb. per acre may be expected. Between the sixth and tenth years, according to elevation, the yield begins to decline. The fruits are borne in succession and have to be harvested carefully by cutting them off with scissors just before the capsules ripen. The picking round is made once in three weeks. II. *Curing*. Green curing now replaces the old laborious method of bleaching and has many advantages including that of an increased price for the product. Green curing in Ceylon is done by two methods, either drying in a chamber heated by an external furnace, or drying over an open charcoal fire in a closed chamber. The latter is simpler and less expensive. Both methods are described. There are notes on sorting, grading and packing.

629. JOACHIM, A. W. R., AND PAUL, W. R. C. 633.841-1.8
Manurial experiments with chillies.

Trop. Agriculturist, 1938, 91 : 217-30.

Manurial experiments were carried out in Ceylon at Anuradhapura and Vavuniya. The variety of chilli used was a horticultural variety of *Capsicum frutescens* L. var. *accuminatum* and is the best dry chilli known in Ceylon. Nitrogenous fertilizers procured very significant increased yields, while the inclusion of phosphorus and potash did not affect yield.

630. PARK, M., AND FERNANDO, M. 633.841-2.8
The nature of chilli leaf curl.

Trop. Agriculturist, 1939, 91 : 263-5, bibl. 3.

PAUL, W. R. C., AND FERNANDO, M.

633.841-2.8-1.8

The effect of manuring on the incidence of chilli leaf curl.

Ibidem, 1939, 92 : 23-7, bibl. 2.

JOHNPULE, A. R.

633.841-2.8-2.6/7

Chilli leaf curl experiments.

Ibidem, 1939, 92 : 28-30, bibl. 3.

The authors of the first paper note that the most characteristic symptom of the leaf curl which occurs in Peradeniya and which forms the subject of their paper is the abaxial curling of the leaf blade. The intervenous areas of the leaf may be distorted. Sometimes there is a partial suppression of the lamina, especially near the petiolar end, which results in narrow strap-shaped leaves. Severely affected plants usually do not flower, probably as the result of the abortion of the reproductive meristems. Fruits, if they appear, may be truncated or curled at the stylar end. Experiments, which are outlined, suggest that insects are directly responsible for the damage. The authors of the second paper report experiments with a leaf curl which is widely distributed throughout the dry zone and shows somewhat different symptoms. Thus here the margins of affected leaves curl in adaxially and the failure of the veins to keep pace with the extension of the leaf surface results in buckling of intervenous areas, which appear deeply concave on the underside of the leaf. As in the other type the size of affected leaves is reduced, but this time there is no necrosis of apical meristems. The internodes fail to reach their maximum length and the plants present a bushy appearance. The fruits are small and malformed. Experiments show that soil deficiency of nitrogen or organic matter is not the cause of the trouble. It is suggested that insects are responsible either directly or as virus vectors. The author of the third paper made experiments with infected material both from Peradeniya and Jaffna. Affected plants were found to be infested with thrips, aphids and mites. Attempts to identify the insect or insects responsible were not entirely successful, though it was established that one species of thrips did bring about a malformation of the leaves.

631. ROLFS, P. H., AND ROLFS, C. 633.85.26.42
Domesticating anti-lepric species in Brazil.

Reprinted from *Leprosy Rev.*, 1938, Vol. 9, Nos. 3 and 4, pp. 18, bibl. 7.

The cultivation of three plant species supposed to be specific against leprosy are discussed in this paper. *Carpotroche brasiliensis* Endl., sapucainha, is a small tree found in Brazil as an undergrowth in forests. It can be successfully propagated by T shield budding. Directions are given for raising the rootstocks from seed of the same variety. The viability of the seeds is quickly lost. Budding follows the usual technique, the tie being of waxed tape which is not loosened for a month. This tree has withstood a temperature of -0.4°C . Budded trees from selected parents are many times more productive than wild trees. *Taraktogenus Kurzii* King, chaulmoogra, is a tree indigenous to Burma. Unlike the previous species seed germinates freely and retains viability for a long time if kept slightly damp. The rootstock seedlings require shelter from direct sunlight. They are easily shield-budded. *Oncoba echinata* Oliv., gorli bush. This shrub could be propagated from cuttings of ripened shoots when suitable high yielding strains have been selected. As a specific against leprosy, however, it is less effective than the other two species. In each case the remedy is obtained from oil produced from the seeds.

632. ROLFS, P. H. 633.85.26.42
 Chaulmoogra e sapucainha. (*Carpotroche brasiliensis* Endl, and *Taraktogenus Kurzii* King.) [Portuguese.]

Reprinted from *Rev. Agric. Brazil*, 1937, Vol. 12, Nos. 5, 6, 7, pp. 8.

The information provided is substantially the same as that by the same author reported in the previous abstract, omitting *Oncoba echinata*.

633. GONSALVES, A. D. 633.859
 O babaçú na economia nacional. (The Macaco nut (*Attalea speciosa* Mart.) and its place in the national economy of Brazil.)

Publ. Minist. Agric. Rio de Janeiro, 1938, pp. 86, bibl. 107.

The palm, *Attalea speciosa* Mart, (*Orbignia Martiana* Rodrig.) is a native of Brazil and is of some commercial importance for the oil of its nuts, which can be put to many uses, for the vegetable ivory also furnished by the nuts, and for numerous by-products of local importance. This bulletin is mainly concerned with statistics of production and export. The natural distribution of the nut is closely examined and the very numerous localities in which it is to be found, many not fully explored, are noted. Apparently it is not cultivated on a commercial scale and only the wild palms are used.

634. ATKINSON, M. 633.912
The difficulties of planting in the dry zones.

Quart. Circ. Ceylon Rubb. Res. Scheme, 1938, 15 : 177-83.

Some practical suggestions for replanting rubber in the dry zones of Ceylon are given. These concern clearing and preparing the land, nurseries, bud grafting and planting. In the dry zone lack of rain often leads to backwardness especially in nurseries. The nursery soil can be kept cool and moist and weed growth checked by a little paddy straw 3 in. deep, or 4 lb. to the sq. yard (8 tons per acre). By taking the trouble to ascertain by experiment the most suitable manure for the district improved results at reduced cost were obtained by the author. Transplanting and after-care are the most vital operations in the dry zone. Ring-barking in the nursery 10 days before planting has given excellent results but is subject to the necessity of transplanting to the field 10 days later, irrespective of the weather conditions. The best of several methods tried is to lift the plants with as little damage as possible to the root system, cut off the stock top 4 inches above the bud patch and wax the cut end, dip the roots into a barrel of fairly thick liquid cow dung, pile the stumps into convenient loads and cover with leaves, plant out the same day and completely shade, water if the soil is not completely saturated. Budding in the field is often satisfactory. Four seeds are sown in each hole, the two best are budded

and the best of these finally retained. Germinated seeds in baskets can be damaged by wind when young and are best stored in trenches 3 ft. wide \times 3 ft. deep until ready for planting. After planting protection baskets for each plant are necessary if all are to be saved. It should be remembered that a replacement is always at a disadvantage because of the more rapid development of the neighbouring trees. Poor yields in dry districts are as often as not due to a lack of humidity round the tapping panel due to over-exposure to the sun and strong drying winds. There appear to be certain clones suitable to dry districts in which resistance to these troubles is marked, either because of the heavier shade cast by their tops or for other reasons undetermined.

635. MURRAY, R. K. S.

633.912-1.541.11

The bud graft as a composite plant.

Quart. Circ. Ceylon Rubb. Res. Scheme, 1938, 15 : 166-74.

The stock-scion relationships of rubber, in so far as they are at present understood, are briefly reviewed. Scion influence on yield of stock does exist in some cases but is of limited practical importance. Stock can influence rate of development and yield of scion; this influence becomes more marked as the tapping cut approaches the union. Some clones are probably more susceptible to stock influence than others. This influence is attributed to vigour on the part of the stock, to its high yielding capacity and compatibility with the cortical tissues of the scion. The time is at hand when the use of seedlings of unknown parentage as stocks will not be considered sufficient for the scion to develop its full productive capacity.

636. BERTRAND, H. W. R.

633.912-1.8

Some aspects of manuring rubber.

Quart. Circ. Ceylon Rubb. Res. Scheme, 1938, 15 : 184-99.

The author, who has been growing rubber in Ceylon for many years, discusses the manurial practices on his estate. Organic manure should not be bought but produced on the estate. In any case inorganic manures are to be preferred. They cost less for the value given compared with organics and they do not require forking in. An experiment is described in which a uniform slope was divided into 4 blocks which were respectively (a) left unforked, (b) lightly forked, (c) deep envelope forked, (d) very deeply forked with big pick-axes. After the monsoon the silt pits on the (a) unforked land were empty, in (b), (c) and (d) blocks they were $\frac{1}{4}$ full, $\frac{3}{4}$ full, overflowing and full of white sand, i.e. with all humus and colloids gone, respectively. Even envelope forking causes much root damage; to break up a root system and immediately apply a rapidly convertible or soluble manure seems illogical. As for run off of soluble manures on unforked land experiment has shown that it takes $\frac{3}{4}$ inch of rain before any run off occurs, thus the solubles are taken under the surface before the run off begins. The time of application is discussed at length. It is concluded that there is a strong case for broadcasting inorganics in old rubber in early spring or just after the S.W. monsoon. Nitrogen in large doses of 70-80 lb. per acre is the first essential in reconditioning neglected trees; a complete fertilizer is better still but useless in small doses and, therefore, on the ground of expense it is suggested that nitrogen should be applied first, with phosphoric and potash later, omitting potash altogether if economy is of importance. Later in the paper, however, the value of potash is demonstrated for young rubber. The time to manure newly planted young rubber is in the period of drought which follows the planting season in Ceylon. It is true that the rubber will have few laterals, but the tap root will pick up the nutrient. The theory held by many that the tap root does not take up nutrients is disproved by the almost immediate improvement this manurial practice effects. Four oz. soluble N.P.K. followed in 2 months by another 4 oz. is recommended. Budded stumps should not be allowed to put out top shoots on the stock after transplanting. In an experiment far the best results were obtained with those stumps on which the top shoots were removed in the bud stage. It is suggested that the top shoots, if allowed to grow, exhaust all the starch in the stock leaving insufficient to grow the inserted bud up to the effective photosynthetic stage. The longer stock also increases both desiccation and the expense of shading. Root growth of nursery rubber should be encouraged before transplanting. The author has produced

excellent results by cutting round the root system 3 weeks before transplanting, but the plants so treated had been previously well stimulated with nitrogen. The practice of indiscriminate manuring of planted rubber is condemned. The weakest trees should get the biggest doses, and if they fail to respond after the second application they should be eliminated.

637. KOROTKOVA, Z. I. 588.83 : 634.1/7

The feijoa. [Russian, English summary 14 lines.]

Trud. Intr. Nurs. subtr. Cult. Sukhum, 1937, No. 3, pp. 39, bibl. 22.

This is a monograph on *Feijoa Sellowiana* containing notes on its cultivation, distribution, varieties and forms and on the manufacture of food products from its fruits.

638. GOULD, H. P. 634.418

The native papaw.

Leaflet. U.S. Dep. Agric. 179, 1939, pp. 6.

The distribution in U.S.A., habit of growth and cultivation of the papaw (*Asimina triloba*) including propagation methods and, finally, uses are discussed here.

639. OPPENHEIMER, C. 634.441

Acclimatization of mango in Palestine.

Hadar, 1938, 11 : 331-4.

The acclimatization of the mango in Palestine began in 1929 with Egyptian seeds, apparently of mixed origin. So far no frost damage has been recorded. A number of varieties have been identified and the best of these and some unnamed seedlings of merit have been selected for propagation. The bulk of the mango harvest in Palestine is harvested in August and September, thus bridging the local gap between grapes and citrus. It is not considered that an export trade is possible, but there should be good commercial possibilities in the home markets.

640. RIPPERTON, J. C., MOLTZAU, R. H., AND EDWARDS, D. W. 634.57

Methods of evaluating the macadamia nut for commercial use and the variation occurring among seedling plantings in Hawaii.

Bull. Hawaii agric. Exp. Sta. 79, 1938, pp. 26, bibl. 8.

The results are reported of investigations by the Hawaii Agricultural Experiment Station on development of methods for evaluating the macadamia nut from the standpoint of a shelled roasted product. Specific gravity of the macadamia kernel has a very high negative correlation with the oil percentage, and thus a rapid method for determining oil content is provided. Specific gravity is also related to roasting quality, i.e. grade 1 has a specific gravity less than 1, grades 2 and 3 have specific gravities of 1.000-1.025 and over 1.025 respectively. Only grade 1 kernels are used at present in commercial packs. A single value known as quality ratio was established which designates the pounds of unshelled nuts as received necessary to produce 1 lb. of grade 1 kernels. Great differences were found in quality ratio of commercial shipments of unshelled nuts. There is among seedling trees great variation in nut characteristics in almost every direction. Smooth-shell types seem to be significantly superior in kernel quality and adaptation to the roasted pack.

641. JOHNS, R. 634.61

A study of coconut palm yields and seed selection in Zanzibar.

E. Afr. agric. J., 1938, 3 : 186-94.

There is wide variation in the coconut plantations of Zanzibar largely on account of the collection of seed nuts at random from storage heaps on the field. Seed selection is a necessity. The characters of high yield are considered to be: (1) Large numbers of visible nuts evenly distributed around the crown. (2) Large number of visible immature nuts, buttons and flowering spathes evenly distributed round the crown. (3) Short flower stalks. (4) Wide open crowns with evenly

distributed fronds. (5) Freedom from gummosis. (6) Absence of immature nut fall. Information obtained as a result of close investigations shows (a) a wide variation in yield between palms; (b) a strong positive correlation between number of nuts and weight of unhusked nuts; (c) a wide variation in colour of husk and in shape and size of unhusked nuts, though these characters could not be correlated with yield; (d) that there was a strong positive correlation between weight of husked nuts and weight of copra; (e) that there was a strong positive correlation between number of nuts and copra yield. Rubbery copra is usually associated with immaturity, but is likely to be caused also by nutritional deficiency. A study of site qualities is indicated; (f) that the average nut copra weight ratio of 1 : 0.44 lb. in Zanzibar from selected trees indicates the smallness of the local nut; (g) that gummosis is widespread in Zanzibar but does not seem as a rule to affect copra quality or yield; (h) that preliminary investigations show a variation of from 61.7% to 70% in oil content (9% is significant), but that these figures require further confirmation.

642. DWYER, R. E. P.

634.61-1.52

Coconut improvement by seed selection and plant breeding.

New Guinea agric. Gaz., 1938, 4 : 3 : 24-102, bibl. 68.

In this lengthy and well-documented article the subject of coconut improvement is treated very fully. Individual palms in any plantation show a wide range of growth characteristics and fruiting ability and in an unselected area a very large proportion of the palms are shown to be uneconomic producers. The somewhat crude methods of selection in New Guinea are described and this is followed by various suggestions for the most efficient procedure advanced by workers in other countries. If properly carried out selection should bring yield increases of 20%, whereas an increase of 10% would amply repay the extra cost. Other subjects dealt with are:—regional strains, coconut varieties and abnormalities, morphology and development of spathes and flowers, nut setting and nut fall, problems of pollination, nursery seedling selection and selective replanting. In the second part coconut breeding is discussed. Controlled coconut breeding must be left to the institution, since individuals cannot hope for success chiefly owing to the long intervals between generations. A brief outline of the aims of the coconut breeder are given.

643. FROGGATT, J. L.

634.61-2.754

Measures for control of coconut tree-hopper (*Sexava* spp.).

New Guinea agric. Gaz., 1938, 4 : 3 : 3-6.

Methods of biological control of the coconut tree-hopper (*Sexava* spp.), which have been recently undertaken with varying success, are briefly mentioned. Tanglefoot bands fastened round the trunks of the palms caught large numbers of first stage and a lesser number of second stage nymphs. It is an expensive method, though possibly valuable in the early stages of an outbreak. Spraying and dusting methods are under investigation. In laboratory trials derris powder has proved the most effective. Failing the use of insecticide the following measures may prove useful. Lighting fires between the palms to produce volumes of hot smoke, with a line of boys to collect the adults and nymphs descending from the palm heads; collection of insects—mainly females—as they descend the palm trunks at night to deposit the eggs; collection of eggs; turning over the soil surface with hoes, a process which either exposes the eggs to predators and desiccation or destroys them by deep burying. Poison baits were useless with the tree frequenting locusts.

644. NIXON, R. W., AND MOORE, D. C.

634.62

Date growing in the United States.

Leaflet. U.S. Dep. Agric. 170, 1939, pp. 8.

Dates are grown in the U.S.A. in the warm inland valleys of Southern California and Arizona. This leaflet considers the following aspects of date cultivation in the States:—climatic requirements, varieties, pollination, propagation, soil management, pruning and thinning. A large section is devoted to pests and diseases.

645. FREEMAN, H. J. 634.771
Banana growing in Queensland.
Qd agric. J., 1938, **49** : 44-57, 121-5, 238-41, 327-331, 437-42, 636-43 ; **50** : 34-43.

A complete account is given of banana growing in Queensland and the methods employed in each branch of the industry.

646. LARTER, L. N. H. 634.771
Banana varieties in Jamaica.
J. Jamaica agric. Soc., 1938, **42** : 460-8.

A description, sufficient for recognition, is given of the banana varieties at present growing in Jamaica.

647. WALLACE, C. R. 634.771-2.76
Unpoisoned baits for reducing populations of banana beetle borer (*Cosmopolites sordidus*).
J. Aust. Inst. agric. Sci., 1938, **4** : 157-60.

The baits consisted of cylindrical sections of banana pseudostems, cut $2\frac{1}{2}$ -3 inches thick and varying in their relative content of rhizome and leaf-sheath tissue. Each sliced bait was placed flat on the ground in the stool and covered with a quantity of dead banana leaves. The greatest number of beetles were taken when the baits were laid in the stools, not between them, and kept down for 6-8 days. The yield of beetles per seven days baiting was found to be about 17% of the population of the stools.

648. POLAND, G. L., MANION, J. T., BRENNER, M. W., AND HARRIS, P. L. 634.771 : 581.192
Sugar changes in the banana during ripening.
Industr. Engng Chem. (Industrial edition), 1938, **30** : 340-2, bibl. 13.

Total sugars increased from less than 2% in green to approximately 20% in fully ripe bananas. Total reducing sugars rose from 3.69% in the partially to 7.45% in the fully ripe fruit, increasing in the process from 32 to 38% of total sugars. Sucrose increased from 7.95 to 12.08%, but showed a decrease from 68 to 62% on a per cent. total sugar basis. The relation of glucose and fructose to total reducing sugars remained fairly constant, glucose amounting to approximately 58%, fructose to approximately 42% of total reducing sugars regardless of stage of ripeness. On a fresh pulp basis glucose increased from 2.24 to 4.21% and fructose from 1.45 to 3.24%. [From authors' summary.]

649. SIDERIS, C. P., KRAUSS, B. H., AND YOUNG, H. Y. 634.774-1.84
Assimilation of ammonium and nitrate by pineapple plants grown in nutrient solutions and its effects on nitrogenous and carbohydrate constituents.
Plant Physiol., 1938, **13** : 489-527, bibl. 15.

Results are presented of experiments conducted under greenhouse conditions with pineapple plants grown in water cultures containing either nitrate or ammonium salts as sources of nitrogen. The objects were to get data on growth, chlorophyll and moisture content of the different tissues and distribution of different nitrogenous fractions, the latter to furnish information on the mode of assimilation of ammonium and nitrate nitrogen. The data are here tabulated, graphed and discussed. In a subsequent publication similar data will be presented in plants grown under various other conditions and manured with either ammonium sulphate or sodium nitrate.

650. MAGISTAD, O. C., AND FRAZIER, T. O. 635.1/7 : 635.952.2
Production and marketing of truck crops in the territory of Hawaii.
Bull. Hawaii agric. Exp. Sta. **78**, 1938, pp. 46.

The bulletin deals with statistics relating to the production and marketing of vegetables in Hawaii. Field experiments and varietal studies are being made of beans, beets, broccoli,

cabbage, carrots, chard, egg plant, onions, peas, peppers, rutabagas, tomatoes and turnips. Mimeographed quarterly progress reports can be obtained from the Hawaii Agricultural Experiment Station.

651. STOREY, H. H., AND NICHOLS, R. F. W. 635.23 : 632.8
Studies of the mosaic diseases of cassava.
Ann. appl. Biol., 1938, 25 : 790-806, bibl. 35.

The cassava mosaic is found to consist of many strains which the authors have classed according to the symptoms induced into two groups, mild and severe. The viruses have been transmitted by grafting but not by needle or hypodermic injections. A reliable single-leaf cage technique has been developed based on the fact that a *Bemisia* sp. can transmit both strains through immature leaves and that the virus so transmitted does not pass out of the leaf until the end of 8 days. Its progress in the plant after entering the stem is noted. Inoculation with a mild strain did not immunize from infection induced by grafting with a severe strain and only very slightly immunized from infection induced by insect inoculation.

652. PAUL, W. R. C., AND JAYASUNDERA, E. S. 635.64 : 631.8
Spacing and manurial experiments with tomatoes. I.
Trop. Agriculturist, 1938, 91 : 208-12.
PAUL, W. R. C., AND JOACHIM, A. W. R.
Spacing and manurial experiments with tomatoes. II.
Ibidem, 1938, 91 : 213-6.

I. The first experiment was carried out at Anuradhapura, Ceylon. The spacings compared were $3 \times 1\frac{1}{2}$ ft. and 3×1 ft., the plants pruned to a single stem and individually staked. The closer spacing gave an increased yield of 881 lb. per acre. The fertilizer treatments gave no results. II. The second experiment was carried out at Jaffna, Ceylon. The spacings compared were 3×1 ft. and $3 \times \frac{3}{4}$ ft. the plants pruned to a single stem and trained on upright trellises. No significant results were obtained either in spacing or from the fertilizers. It is suggested, in the light of this and experiments elsewhere, that 3×1 ft. is the optimum spacing for this method of pruning and training.

653. PARK, M., AND FERNANDO, M. 635.655
A further experiment on soya inoculation in Ceylon.
Trop. Agriculturist, 1938, 91 : 201-7, bibl. 6.

Seed inoculation experiments are described with a large-seeded variety of soya bean resembling Mammoth Yellow and a small yellow-seeded variety from Poona. The seeds were surface sterilized by immersion in 0.1% mercuric chloride solution and were inoculated with 4 strains of *Rhizobium japonicum* Kirch (4 treatments). The large-seeded variety did not respond. The small-seeded variety reacted markedly and significantly in growth and nitrogen content of seeds. Differences in yield could not be satisfactorily determined owing to the high experimental errors.

STORAGE AND MARKETING.

654. EAVES, C. A. 634.11-1.547.6 : 664.85.11
Maturity and storage problems.
Seventy-fifth annu. Rep. Nova Scotia Fruit Growers' Ass. (Jubilee edition)
for 1938, pp. 105-8.

The author briefly notes the desirability for picking and shipping at the right time and discusses how this can be achieved. He also notes that apples which are headed in the barrel before storing do not lose so much water and hence keep their condition better. The search must continue for methods of storing, including the use of gas, which will enable growers not to flood the market at any given time with best dessert apples.

655. HILGEMAN, R. H., AND SMITH, J. G. 634.62-1.547 : 664.85.62
Maturation and storage studies with soft varieties of dates.

15th annu. Rept. Date Growers' Inst., 1938, pp. 14-7, bibl. 8.

Early ripening varieties of dates in U.S.A. should not be picked until the translucent stage is reached. No significant differences were apparent between high heat processing at 140° F. and 150° F. for intervals of 2-4 hours. The success of the treatment is limited by the amount of moisture in the date, but in general it produces inferior dates to those processed at lower temperatures. Moisture-proof containers retard the formation of sugar crust and sugar spot but accelerate darkening and deterioration in flavour. The relative humidity of the cold storage room should be regulated according to the moisture content of the dates stored.

656. WALSH, F. W. 664.85.11 + 634.11 : 658.8
Observations on marketing in Great Britain.

Seventy-fifth annu. Rep. Nova Scotia Fruit Growers' Ass. (Jubilee edition) for 1938, pp. 74-81.

The points, which are made especially for Nova Scotian apple growers, apply to a much larger field. 1. Study the market requirements so as to supply the market with a volume with which it can deal each week. 2. Reduce the volume of certain varieties e.g. Gravensteins and Starks. 3. Eliminate shipments of odd varieties in small quantities. 4. Insist on sending uniform lots. 5. Reduce the number of marks and brands. 6. Have better storage facilities to ensure the delivery of firmer apples at destination. Investigation suggests that packs with a good reputation for firm apples originated from warehouses equipped with artificial refrigeration.

657. GERHARDT, F., AND RYALL, A. L. 664.85.23.035.1
The storage of sweet cherries as influenced by carbon dioxide and volatile fungicides.

Tech. Bull. U.S. Dep. Agric. 631, 1939, pp. 20, bibl. 24.

In 1935 and 1936 storage experiments with sweet cherries were made at Yakima, Washington. The following notes are taken from the summary: —Bing and Lambert cherry varieties could be held in CO₂ without impairment of flavour at 60° F. for 12 days in 40% CO₂; at 45° F. for 10 days in 75% (Bing only); at 45° F. for 20 days in 40%; at 45° F. for 17 days in 25% (also Napoleon); at 32° F. for 31 days in 10%. Storing sweet cherries for 17 to 20 days at 45° F. in 25% CO₂ controlled fungal decay. Since concentrations of 40% produced no injury to the fruit at 45° F. it is evident that the gas may safely be used over a rather wide range of concentrations. The addition of 25% CO₂ to the storage atmosphere at 45° F. was more effective in preventing decay in sweet cherries than was a 30% drop in temperature. Cherries stored in atmospheres with 25% CO₂ at 45° F. had a better appearance and were in better condition than air-stored cherries at 32° F. 15% CO₂ retarded the decay developing at 40° F. more effectively than air storage at 32°. Surface pitting was reduced by storing the cherries in atmospheres containing 15 and 20% CO₂. The possibility of using CO₂ at transit temperatures during freight shipment of sweet cherries is discussed. Sodium bisulphite, methyl bromide and dichloramine T showed little fungicidal value. Iodol and thymol iodide gave little promise as fungicides for the control of *Penicillium* and *Rhizopus* rots of cherry. Elemental iodine effectively controlled the growth of these organisms, but only when used in concentrations sufficient to produce lenticel burning and surface discoloration of cherries.

658. WARDLAW, C. W. 664.85.653
Storage investigations with Trinidad avocados, 1938.

Trop. Agriculture, Trin., 1939, 16 : 28-30, bibl. 8.

Following a season of abnormally high rainfall five varieties of avocado in Trinidad, picked full-grown green, have been under observation, unwrapped and uncrated, at given temperatures between 40° F. and 60° F., with relative humidities between 78% and 87%. St. Joseph No. 2 and St. Joseph No. 3 had been selected in a previous season as possessing the required

cold resistance in storage. St. Joseph No. 2 confirmed the previous findings that it ranks as a variety well suited to export requirements. St. Joseph No. 3, previously selected for its high degree of cold resistance in storage, this year was characterized by an excessive wateriness and in consequence was distinctly subject to chilling injury. A pure Guatemalan type grown in Trinidad was also subject to chilling injury in storage. A close relationship between the onset of the maturation processes and chilling injury was again observed. Fungal injury was slight.

659. ANON. 664.85.3 : 632.48
La moisissure bleue et la moisissure verte des fruits d'aurantiacées. (*Penicillium italicum* Wehm. et *P. digitatum* Sacc.) (Blue and green moulds of citrus.)
Memento Déf. Vég. Rabat, **55**, 1938, pp. 12.

Symptoms, cause, development and spread of *Penicillium* rot of citrus fruits are here described, the nature and amount of damage are noted and control measures are discussed. These consist in the prevention of fruit injury, various chemical treatments and cold storage.

660. BRATLEY, C. O., AND MASON, A. S. 634.774-2.48
Control of black rot of pineapple in transit.
Circ. U.S. Dep. Agric., **511**, 1939, pp. 12, bibl. in text.

Benzoic acid in alcoholic solution was the most effective of several materials tried for the control of black rot of pineapples caused by *Thielaviopsis paradoxa* (De Seyn.) Hoehn.

661. WOODROOF, J. G. 664.85.037 + 664.84.037
Microscopic studies of frozen fruits and vegetables.
Bull. Ga Exp. Sta. **201**, 1938, pp. 46, bibl. 34.

From an examination of more than a dozen fruits and vegetables frozen by immersion, it was proved to be possible and practical to freeze sufficiently rapidly to produce ice crystals, as small as, and within, individual cells, resulting in less than one per cent. cell rupture and as low as two per cent. leakage with no immediate change in colour. No leakage and very little loss of structure was obtained from frozen starchy products such as peas, corn and lima beans. Owing to the sponginess of this material, having the capacity to release or re-absorb large quantities of water without altering its structure, rapidity of freezing is not nearly so important as with non-starchy products. Results of these experiments indicate that quick freezing can be accomplished by immersing in a liquid at 0° F., provided the solution is agitated and the product is in relatively small pieces. Storing at from 0° F. to 5° F., is necessary to keep the product fully hardened. Thus the temperature requirements are: quick freezing, rapid hardening, and constant storage, all of which were successfully accomplished at 0° F. [From author's summary.]

PACKING, PROCESSING AND PLANT PRODUCTS.

662. DEPARTMENT OF AGRICULTURE, ADELAIDE. 634.11 : 382.6
Apple export.
J. Dep. Agric. S. Aust., 1938, **41** : 845-50.

This is a continuation of an article bearing the same title (*Ibidem*, 1937, **41** : 462-7 ; *H.A.*, **8** : 409) and contains instructions for harvesting and packing the apple crop for export. Descriptions are given of picking bags, filling cases and field boxes. (The article will be continued.)

663. WELLMAN, R. F., AND HEALD, F. D. 634.11-1.564 : 632.9
Steam sterilization of apple boxes for blue mold.
Bull. Wash. St. agric. Exp. Sta. **357** (Technical Paper), 1938, pp. 16, bibl. 22.

A direct exposure to streaming steam for one minute is sufficient to kill a very high percentage of the spores of *Penicillium expansum*. Spores that have been dried for two weeks are more

readily killed by streaming steam than those which have been dried for a few hours only. Spores mixed with decayed apple tissue in contact with apple-box wood are more difficult to kill with streaming steam than spores free from decayed tissue. Spores between two pieces of wood, as in joints, are somewhat protected from the action of streaming steam, but under the experimental conditions were killed within two minutes. Spores of *P. expansum* on artificially contaminated and on naturally contaminated box-wood did not differ appreciably in their resistance to streaming steam. In commercial practice a two-minute exposure to streaming steam of old packing boxes, which are to be used again, would be sufficient to kill all blue mold spores present. [Authors' summary.]

664. EIDT, C. C. 634.85.11.047

Principles and methods involved in dehydration of apples.

Publ. Canad. Dep. Agric. **625**, 1938, pp. 36, being *Tech. Bull.* **18**.

In Nova Scotia early autumn apple varieties are not suitable for dehydration. Size of fruit affects both the cost of preparation and the quality of the product, small sizes being more expensive to prepare and producing more chips in the finished product. Apples of less than 2¼ inches in diameter are uneconomical to pare. All rotten, badly pitted or deformed fruits should be removed as their presence slows down preparation and lowers the grade of the finished product. The dehydrator has certain advantages over the evaporator in producing dried apples. The single tunnel, properly operated, makes a very efficient unit for apple dehydration. Even air flow is essential for uniform drying. It must be carefully baffled to force it through the trucks without by-passing them. Pared apples give up their moisture readily. A long tunnel seriously affects quality and slows down the drying operation. With air circulating at approximately 1,000 feet per minute through the dehydrator the ideal load was found to be 6 trucks, which means air circulating over 24 feet of fruit. Two lb. of prepared fruit to the square foot of tray surface gives even and efficient drying when fruit is evenly trayed over its surface. Hot-end loading in the single, short tunnel gave a much superior product than did the cool-end loading method. Storage facilities are necessary for a dehydration plant under Canadian conditions. Sulphuring is necessary to bleach fruit before drying. More effective sulphuring was obtained experimentally in the slice than with whole apples. [From author's summary.]

665. CHILD, A. M., AND BRAND, R. 634.11 : 641.5

Culinary quality of apple varieties grown in Minnesota.

Tech. Bull. Minn. agric. Exp. Sta. **128**, 1938, pp. 23.

This bulletin gives the results of a study of Minnesota apple varieties as regards their qualities for baking, sauce, pie and jelly. Full details are given for making and testing these products.

666. JOSLYN, M. A., BEDFORD, C. L., AND MARSH, G. L. 664.84.32.037

Enzyme activity in frozen vegetables. Artichoke hearts.

Industr. Engng Chem. (Industrial edition), 1938, **30** : 1068-73, bibl. 41.

A study of catalase, phenolase, ascorbic acid, oxidase and peroxidase enzymes of artichoke hearts in relation to their discolouration in air.

667. ANON. 633.72 : 581.192

Chemical composition of green tea. [Russian.]

Foreign Subtropics Experience, 1938, No. 7, pp. 3-11, bibl. 4 (Japanese).

This is a summarized report of the research on processed green tea leaves carried out by the Japanese scientists S. Maruyama, R. Jamamoto, I. Oshima and M. Tsujimura.

668. ROBERTS, E. A. H., AND SARMA, S. N. 633.72-1.56

The fermentation process in tea manufacture I. The role of peroxidase.

Biochem. J., 1938, **32** : 1819-28, bibl. 17.

669. WILBAUX, R. 633.73-1.56
 Recherches sur la préparation du café par voie humide.* (**Research on the preparation of coffee by the wet method.**)
Publ. Inst. nat. Étude agron. Congo belge, Sér. tech., **21**, 1938, pp. 45, bibl. 10, 15 francs.

A series of experiments on preparing robusta coffee by the wet method are described. Owing to their technical nature they cannot usefully be abstracted.

670. THE WATER BOARD, KENYA. 633.73-1.56 : 614.777
Pollution of streams by coffee effluent.
Mon. Bull. Coffee Bd Kenya, 1938, **4** : 208-9, 1939, **5** : 12-5.

An interim report of the Coffee Pollution Committee of the Water Board of Kenya is presented. Pollution is divided into two heads :—(a) Pollution through drainage and seepage into the rivers from decomposing pulp heaps, a more or less continuous process. (b) Pollution caused by the addition of solid matter to the various effluents produced by pulping and washing coffee. Each of these conditions is discussed and provisional recommendations are made.

671. KELLY, E. C. 634.61+658.8
Suggestions for the improvement of New Guinea copra. The employment of sulphur dioxide gas in the curing of copra.
New Guinea agric. Gaz., 1938, **4** : 4 : 63-6, bibl. 2.

Not only does the treatment of fresh copra by sulphur fumigation prevent the immediate growth of moulds, but also the fumes remain in the meat long enough to allow the escape of water and to prevent the growth of new mould spores. The treatment is particularly useful should there be any delay between cutting and drying. The process and apparatus are fully described.

672. THERON, C. J., AND NIEHAUS, C. J. G. 663.25
Wine making.
Bull. Dep. Agric. S. Afr., **191**,† 1938 (?), being
Fmrs' Bull. Series, **130**, pp. 98.

This bulletin deals with wine-making in the Union of South Africa. The following aspects are examined, each in a separate chapter : grapes, pressing, alcoholic fermentation, the making of dry white wines, the making of dry red wines, cellar processes, fortified wines, faults and diseases of wines, fustage, cellar construction, distillation of brandy on farms, and wine analysis.

673. CAPT, E. 663.253.42
 Dosage rapide de minimes quantités de fer dans les moûts, vins et cidres.
 (**Rapid determination of small amounts of iron in juices, wines and ciders.**)
 Reprinted from *Mitt. Lebensm. Hyg. Bern*, 1938, **29** : 33-44.

A method is here described permitting determination of very small quantities of iron in juices, wines and ciders. While being more accurate than the colorimetric method at present in use at oenological laboratories, it is also sufficiently rapid to enable it to replace the old methods with advantage. Besides, it requires only the ordinary re-agents and presents no greater difficulties than, for instance, the method adapted for determining ash alkalinity. It has been found with the aid of this method that no definite relationship exists between the iron content of Swiss wines and their place of origin.

* See also *Recherches préliminaires sur la préparation du café par voie humide. Ibidem*, **13**, 1937, pp. 50, bibl. 16, *H.A.*, **7** : 1100.

† Replaces *Fmrs' Pamphl. Stellenbosch Elsenburg Coll. Agric.*, **36**, 1931.

674. BENVEGNIN, L., AND CAPT, E. 663.253
Méthode simple de dosage de l'acide carbonique dans les vins. (Simple
method of determining CO₂ in wines.)

Reprinted from *Mitt. Lebensm. Hyg. Bern.*, 1938, 29 : 26-33, bibl. 5.

A simple method is described here for determining carbon dioxide content in wines. With the aid of a rudimentary apparatus, without difficulty, at least as accurate results may be obtained as from most methods in use for determination of other constituents in wines. By applying this method systematically to a great number of Swiss wines it was possible to obtain data which present a certain statistical interest. The CO₂ content in wines was found to range between 0.37 and 2.23 g. per litre.

675. NIEHAUS, C. J. G. 663.25 : 581.192
Studies on the nitrogen content of South African musts and wines.
Sci. Bull. Dep. Agric. S. Afr., 172, 1938, pp. 14, bibl. 5 being *Sci. Bull.*
Stellenbosch-Elsenburg, 28.

Abnormal ripening caused by drought has very little influence on the total nitrogen content of the must. Fertilizing with ammonium sulphate, potassium sulphate, as well as with superphosphate, has no influence on the amount of total nitrogen present in the must. During alcoholic fermentations, such as those which take place under practical cellar conditions, from 50.7 to 58.5 per cent. of the total nitrogen which was present in the must is removed as a result of yeast activity. This loss of nitrogen takes place from the 12th to the 48th hour after the fermentation begins. The quantities of total nitrogen removed from the same must by different strains of yeast differ. These differences however, are very slight. Aeration during fermentation has a favourable influence on yeast production. The quantity of yeast cells produced increases between 15° C. and 25° C. Between 25° C. and 30° C. it decreases. Aeration increases the amount of total nitrogen removed from the must at all temperatures between 15° C. and 30° C. Without aeration the assimilative capacity per unit of yeast cells is higher than with aeration. At some temperature in the vicinity of 25° C. the two strains experimented with show their lowest assimilative capacity. The total nitrogen content of young wines is increased by contact with the lees of fermentation. The highest increase was observed with dry white wines, and the lowest with sweet red wines. [Author's summary.]

676. JOSLYN, M. A. 663.21(46)
Electrolytic production of rancio flavor in sherries.
Industr. Engng Chem. (Industrial edition), 1938, 30 : 568-77, bibl. 49.

The special sherry flavour, which is attributed to a number of circumstances in the Spanish vineyard, is due in part to acetaldehyde or products derived therefrom. A method of electrolytic heating is described which not only increases the aldehyde content but also brings about a rapid blending of the brandy and the wine. It is not entirely satisfactory, as too rapid aldehydrification is thereby induced. Methods of overcoming this undesirable feature are here discussed.

677. NIEHAUS, C. J. G. 663.25 : 581.192
Sugar-alcohol ratios in South African musts and wines.
Sci. Bull. Dep. Agric. S. Afr., 161, 1937, pp. 11.

678. PEDERSON, C. S., AND TRESSLER, D. K. 663.18 : 634.11
Flash pasteurization of apple juice.*
Industr. Engng Chem. (Industrial edition), 1938, 30 : 954-9, bibl. 18.

The process whereby apple juices can be flash pasteurized and canned at 160° F. or higher is described. The effects of holding pasteurization of 15 to 20 minutes and of flash pasteurization and de-aeration are discussed. Holding pasteurization as above results in the killing of yeasts at 155° F. or higher. It is unnecessary to kill all micro-organisms since the bacteria

* See also abstract 687 for memorandum by Charley and Harrison on fruit juices and related products.

which survive the above temperatures cannot grow and the surviving mould spores are checked by the absence of air. Pasteurization at temperatures above 175° F. for one minute was found to impart a slightly cooked flavour to cloudy New York State apple juice. Air must be excluded from the juice. Preservatives such as sodium benzoate or sulphur dioxide in small amounts lower the effective temperature for holding pasteurization, the effect being apparently more pronounced on the yeasts than on the bacteria. The simple canning procedure described here is said to produce a juice of far more and better flavour than any other known process hitherto used.

679. TILLER, L. W. 663.813 : 634.11
Report on unfermented fruit juices with special reference to the apple.
Orchard. N.Z., 1938, 11 : 46-51.

An outline is given of modern methods of fruit juice extraction* and preservation, particularly of apples, with the idea of stimulating the enterprise in New Zealand. Investigations needed in New Zealand concern :—juice yield of local apples, chemical characteristics of juice of New Zealand varieties, behaviour of New Zealand varieties under several methods of processing, blending possibilities to enable utilization of otherwise unsuitable varieties, study of use of pectolytic enzymes, study of the production of unfermented juice from other fruits. The points to be stressed in advertising and propaganda are noted.

680. TEMPANY, M. A. 663.813 : 634.3
The preservation of citrus fruit juices.
Bull. imp. Inst., Lond., 1938, 36 : 334-49.

The existing trade in citrus squashes and cordials in Great Britain is described. The author notes that many people think such beverages are pure fruit juice. Actually they are probably drinking a diluted juice to which has been added sulphur dioxide in the form of potassium metabisulphite, some citric acid, a syrup containing 45 per cent. by weight of sugar and, if the squash purports to be orange, a little carotene for colouring. The difficulties of preserving citrus juice in a fresh condition are considerable since it undergoes changes in storage which involve loss of flavour, colour changes in the pectinous material, and flocculation, none of which can be dealt with satisfactorily by sterilization or even by pasteurization. Five processes have been evolved to preserve fruit juices in the natural state and these are described. They are (a) low temperature storage ; (b) flash pasteurization and canning ; (c) concentration by film evaporation under reduced pressure ; (d) concentration by freezing ; (e) treatment by the Matzka process, a combination of low temperature flash pasteurization and metallic silver sterilization, the liquid being passed in thin layers between two heated metal surfaces. Each process has its disadvantages, which are discussed.

681. EIDT, C. C. 634.11-1.56
Utilization of sub-grade fruit for profit.
Seventy-fifth annu. Rep. Nova Scotia Fruit Growers' Ass. (Jubilee edition)
for 1938, pp. 101-3.

The author gives brief notes on the possibility of profitably utilizing low grade fruit in the following ways :—by drying, by canning and by manufacture of fruit juice.

NOTES ON BOOKS AND REPORTS.

682. ASHBY, H., ASHBY, E., RICHTER, H., AND BÄRNER, J. 016 : 58 : 41.3
German English Botanical Terminology.
Thos. Murby, 1 Fleet Lane, London, E.C.4, 1938, pp. 195, 10s.

This book is not in the form of an ordinary dictionary. Instead, a brief survey of botanica science is given in English and German, the German being a literal translation of the English.

* See also abstract 687 for memorandum by Charley and Harrison on fruit juices and related products.

This is followed by three appendixes. In the first are given the names of common, wild and cultivated plants found mainly in Europe, the English, scientific and German names appearing opposite one another. The second contains a list of the most important common names of plant diseases in English and German, together with the cause of the disease and the host on which it is found, in both languages. Appendix 3 (*a* and *b*) contains common abbreviations used in the botanical literature of both languages with their meaning in English and German. Finally there are good German and English indexes. The whole is clearly printed and should prove extremely useful to German and English scientists struggling with one another's erudite articles.

683. CHUGUNIN, YA. V., AND YUGANOVA, O. N. 581.5.03 : 634.1/7-2.3/7
Phenological calendar for protection of orchards from pests and diseases. [Russian.]
 Moscow, 1938, pp. 188, 5 roubles.

The fruit trees concerned are apples, pears, apricots, peaches, plums and cherries. Of the pests and diseases all the more important ones are noted. All data presented in this illustrated and tabulated report were collected by the author in the Crimea during the period 1930-8.

684. DIRSH, V. M. 634.8-2.6/7
Vine pests and their control. [Russian.]
 Moscow, 1938, pp. 64, 2.50 roubles.

This is a simple guide to Crimean vine pests and their control. Not only pests which time has proved to be of serious economic importance, but also certain others less well known are discussed. Notes are given on poison sprays, their use and precautions necessary, spraying and dusting apparatus, and a phenological calendar for the Crimea is included.

685. INTERNATIONAL INSTITUTE OF INTELLECTUAL CO-OPERATION. 659.1 : 5
International code of abbreviations for titles of periodicals and Supplement.
 2 Rue de Montpensier, Paris, 1930 and 1932, pp. 12 and 18, 2 fr. 50 each plus postage.

In these two brief pamphlets are set out the rules drawn up as the result of the co-operation of the following authorities :—W. A. Smith, editor of the *World List of Scientific Periodicals*,* Dr. Prinzhorn, President of the Ausschuss für Zeitschriftengestaltung, M. Lemaitre, editor of the *Revue des Bibliothèques*, Paris, and Mr. Lundberg of the Upsala University Library. They took as the basis for their deliberations the "World List of Scientific Periodicals" and the German system and as a result drew up this most useful code of abbreviations and its supplement. Before being printed the rules on which they agreed were submitted to their respective organizations, which declared their agreement with them and their willingness to recommend their adoption. The Bureau has frequently been asked for advice on abbreviation of titles and even more frequently to explain the abbreviations used in *Horticultural Abstracts* and various Technical Communications. These abbreviations have, with minor exceptions, been those advocated and used by the World List, especially since the re-issue of that reference work in 1934, and it will be found that they agree largely with those recommended in the Code. A few pence spent on the International Code might prove an excellent investment to many of our readers.

686. WHITELAW, E. W. 633.912-1.536
Practical replanting of rubber.

Times of Ceylon, Colombo and London, 1938, pp. 106, illus. Rs. 7.50.

"Practical" is the operative word throughout this book. A preliminary appeal to the rubber planters of Ceylon to use to the full their opportunities to replant rather than to potter along with old rubber showing decreasing yields is supported by the quoted opinions of Sir Frank

* *A World List of Scientific Periodicals published in the years 1900-1933*, second edition, Oxford University Press, 1934, pp. 780. Price £3 3s.

Stockdale, Agricultural Adviser to the Colonial Secretary, and M. Van den Abeele, Director General of the Belgian Ministry of the Colonies. Then putting generalities aside the author produces authenticated figures to show that whereas under present conditions and with rubber at 9d. a lb. a non-replanted estate will produce a profit of £6,000, an estate of the same acreage partially replanted with 400 acres of the best available planting material would yield a profit of £14,027 or in weight of rubber 640,000 lb. against 375,000 lb. To the question of what is to be done with all this rubber on an overstocked market it is answered that only a limited number of companies can finance replanting and that it is doubtful if the extra rubber they produce will counteract the annual retrogression which is in evidence in almost 100 per cent. of the old rubber standing in the world to-day. Besides, an estate replanted to the limit allowable should be able to face rubber at 3½d. per lb. This concludes Chapter I and the remainder of the book is devoted to the real work, i.e. that which has to be done by the estate superintendent and his labour force. That so small a book is able to contain so much information and instruction is due to the omission of anything in the way of padding, though economy of words has not deprived the pages of an occasional sprinkling of Attic salt, as is contained for instance in the apparently innocent observation on the remarkable frequency with which the most suitable area for replanting seems to be the field round the manager's bungalow. Where two rubber planters are gathered together there will always be discussion, in fact other than the Law there seems to be no occupation so prolific of argument. The author, however, never suffers from doubts. He observes, he comes to a conclusion, he acts or confidently advises others. He adds force to his statements by using the first person singular throughout and contrives to do so without appearing in the least egoistic or engendering any feeling of irritation in the reader. In addition to positive pronouncements as to the right and wrong way to do almost everything connected with the cultivation of rubber the book teems with "bright ideas" and suggestions which bear the marks of sound common sense and careful thought and are well worth the attention of growers interested in getting the most out of their estates while eliminating unnecessary expenditure. The author is nevertheless well aware that "you only get what you pay for" and does not hesitate to point out the occasions when saving pennies may result in losing pounds. There is in conclusion a useful chapter on malaria control in new clearings by Dr. G. Macdonald, Medical Officer to the Malaria Control Scheme. Altogether a most readable and instructive book.

687. CHARLEY, V. L. S., AND HARRISON, T. H. J. 663.813
Fruit juices and related products.

Tech. Comm. Imp. Bur. Hort. Plant. Crops 11, 1939, pp. 100, bibl. 118, 5s.

This bulletin contains in concise form an account of the technique of production of apple juice, and its preservation, with shorter notes on other fruit juices, cider, fruit wines, fruit brandies, cider vinegar, etc. The utilization of by-products is also considered and methods of juice analysis are discussed. The most modern apparatus is described and illustrated. A short glossary is given of terms commonly used in fruit juice production. With the exception of the recent book by Tressler, Joslyn and Marsh entitled *Fruit and Vegetable Juices*, Avi Publishing Co., N. York, \$6.0 in U.S.A., \$6.15 post free elsewhere, it would appear to be the only up-to-date memorandum in English dealing with the technique of this subject, which is daily becoming of greater interest to fruit growers throughout the British Commonwealth.

688. CANADA. 634/5
Report of the Minister of Agriculture for the year ended 31 March, 1938, pp. 116, 25 cents.

Among others the following reports are of particular interest. *Division of Horticulture*. A number of third back crosses from *Malus baccata* have now fruited and many are of full commercial size and quality and possess outstanding hardiness. Experiments show that very satisfactory storage conditions for McIntosh apples are a 7-7½% CO₂ + 14% O₂ atmosphere at 39° F. Varying the type of potash used in the fertilizer seriously affected storage quality in celery. Under Quebec experimental conditions muriate was greatly superior to the sulphate in this respect. Oiling the tin can with white Russian oil makes it possible to can apple juice satisfactorily.

Dehydration of vegetables has been greatly improved. A complete report on the use of phytohormones is in preparation. *Tobacco Division*. Selection and processing. *Exp. Sta., Kentville, N.S.* With autumn varieties of apple the interval between commercial and full maturity is not great and picking should therefore be done in good time. Experiments were carried out on dehydration of apple and were continued on the processing of Clapps Favourite pear by storage at low temperature. *Exp. Sta., Fredericton, N.B.* Nutritional disorders in apples. *Exp. Substa. Ste. Clothilde, Que.* Vegetable manuring. *Exp. Sta., Morden, Man.* In fruit breeding for hardiness outstanding mother parents have been Antonovka, Ostrakoff Charlamoff, Blushed Calville, Wealthy, Duchess, Anisim and Tetofsky. *Exp. Sta., Summerland, B.C.* Fruit variety improvement. Malling I and seedlings of Canada Baldwin are likely to prove good rootstocks in Okanagan orchards. Fruit products investigations on an outlet for Royal Anne cherries have been successful. *Exp. Farm, Agassiz, B.C.* The nut orchard continues to grow well and produce promising trees. *Exp. Sta., Sidney, B.C.* Experiments on small fruits are noted. *Fruit Branch*. An account is given of the work of this branch. Its primary function is the administration of the Fruit, Vegetables and Honey Act, the Meat and Canned Foods Act (Fruits and Vegetables) and the Maple Sugar Industry Act. *Economics Branch*. Notes on distribution costs of fruits and vegetables, apple prices.

689. CANADA, DEPARTMENT OF AGRICULTURE. 351.823.1 : 634/5
The Fruit, Vegetables and Honey Act and Regulations.
 Ottawa, 1938, pp. 136.

690. CARNEGIE INSTITUTE OF WASHINGTON. 581.08
Annual report of the Chairman of the Division of Plant Biology.
 (Reprinted from *Yearb.* 37, for the year 1937-8, December, 1938), pp. 32.

Among the fundamental research projects, short accounts of some of the results of which are given here, those most nearly touching certain phases of horticultural research work are the following :—*Biochemical investigations*—Leaf pigments, carbon dioxide absorption by illuminated leaves, amylolytic activity of leaves, the quantum efficiency of photosynthesis. *Experimental taxonomy*—chromosome number and environment. *Investigations on the cambium and its derivative tissues*. *Desert investigations*. A list is given of publications by members of the staff during the year 1937/8.

691. C.S.I.R. AUSTRALIA. 634.1/8 + 664.85
Twelfth Annual Report of the Council for Scientific and Industrial Research for year 1937-38, 1939, pp. 96, 4s.

Reports of progress will be found with regard to the many horticultural schemes sponsored and aided by the C.S.I.R. Among them are the following :—II. *Plant investigation*. 4. Fruit. Previous work indicating a correlation between larger size and lower keeping quality in Cleopatras is confirmed. The use of maleic acid for paraffin-oil apple wrappers resulted in better looking fruit but no difference in storage disorders. Certain deficiency diseases, e.g. "dimple" in Cleopatra and Granny Smith failed to respond to boron. The immunity of Merton apple stocks (Malling II × Spy) to woolly aphis has been maintained and stock trials have been laid down with Granny Smith and Jonathan budded on them. No success was achieved by treating hardwood apple cuttings to induce root formation. 6. Tobacco investigations. III. *Entomological problems*. 8. Orchard and fruit pests :—*Cydia molesta* and *C. pomonella*. IV. *Weeds Investigations*. VII. *Irrigation Settlement Investigations*. A. Merbein, Victoria. 5. Viticultural studies. The crop increases associated with applications of nitrogenous fertilizer are also associated with reduced quality of crop. 6. Fruit processing. Progress is reported on the stabilization and study of the dipping solution. Pest control in dried fruits is now comparatively satisfactory. Immersion of sultanas in a 2% solution of SO₂ gas is found to improve and preserve the colour. B. Griffith, N.S.W. 3. Alternate cropping of Valencias. Tests have shown the advisability and efficacy of fruit thinning in the on-year. The effect of the time of application of nitrogenous fertilizers on

the biennial habit is also being studied. IX. *Food Preservation Investigations*. 3. Citrus. Data are being accumulated on the storage of Washington Navel and Valencia oranges. Investigations on the pathology of storage spot lesions in these oranges are continuing. Washington Navel oranges appear to be less prone to storage spot when they have passed the climacteric and reached the phase of constant respiration. A temperature of 50° F. appears to be a satisfactory storage temperature for grapefruit. 4. Non-tropical fruit investigations. The fact that gas storage did not further increase the life of peaches during the last year contrasts with results of three previous years and is attributed to greater maturity at time of storing. Gas storage of pears in an atmosphere containing 5% CO₂ at 32° F. resulted in a 50% increase in storage life in four varieties. Cork filling as packing for grapes was found to be superior in controlling mould to paper and woodwool. Gas storage of Jonathans in atmospheres containing 5% CO₂ and 10-16% O₂ at 32° F. increased the storage life, mainly by control of Jonathan spot. Higher concentrations of CO₂ and lower concentrations of O₂ proved injurious.

692. DATE GROWERS. 634.62
Fifteenth Annual Date Growers' Institute, 9 April, 1938, Coachella
Valley Farm Center, California, pp. 29.

Subjects dealt with at this conference include the following :—Effect of soil moisture on fruit size. "Decline" disease. Management of fruit bunch (*H.A.*, 9 : 292). Ripening and storage of soft varieties (*H.A.*, 9 : 655). Storage of date pollen (*H.A.*, 8 : 877). Leaf pruning and fruit thinning following the freeze of January 1937.

693. DEVELOPMENT COMMISSION. 63
Twenty-eighth report of the Development Commissioners, being for the year ended 31 March, 1938.

H.M. Stationery Office, Kingsway, London, W.C.2, 1939, pp. 184, 3s.

Notes on grants made to educational and research institutes concerned with agriculture and fisheries in the U.K. in the year 1937/1938.

694. DURHAM COUNTY COUNCIL. 634/5
Houghall Record 1938, pp. 75.

The account of the Horticultural Station (pp. 21-53) includes figures of crop production of fruits, vegetables and bulbs as well as details of cultivations, manuring, waterings, etc., in many cases. Interesting photographs are given of the erection of a large Dutch glasshouse and of making up Dutch type frames.

695. EDINBURGH AND EAST OF SCOTLAND COLLEGE OF AGRICULTURE. 634/5
Report on the work of the College for the year ending 30 September, 1938, Edinburgh, 1939, pp. 96.

Educational work in horticulture and experimental work in the College garden including manurial and varietal trials of fruits, pruning trials and pest and disease control are noted.

696. HOPKINS, R. H., NORRIS, F. W., AND PREECE, I. A. 663.4
Report on the fermentation industries for 1938,* 1939, pp. 32,
bibl. 145.

This report, which will be of the greatest interest to those engaged in the technical problems of brewing beer, consists of brief reviews of the most outstanding scientific work in this field published mainly in 1937 and 1938. References are given in all cases to the source of the information.

* Prepared for the Society of Chemical Industry and the Institute of Brewing.

697. **GEISENHEIM AM RHEIN.** 634/5
Wissenschaftlicher Jahresbericht der Versuchs- und Forschungsanstalt für Wein-, Obst- und Gartenbau, 1937. (Annual report of the Geisenheim Horticultural Research Station for 1937.)

Paul Parey, Hedemannstr. 28, Berlin, S.W.11; 1939, pp. 38.

This report is divided as follows:—*Director's Laboratory.* 1. Investigations on pear scab (*Venturia pirina*), its method of spread and life history. 2. Growth promoting substances. 3. Pollination studies. 4. Walnut and hazel research. As regards walnuts great success is claimed for a new method of summer budding in the open, which is said to be cheap, reliable and economic of material. [It is not described and no published description of the process is yet available.—ED.] In the summer of 1937 420 2-year-old *J. regia* and *J. nigra* seedlings were budded, a take of 72% being achieved, the failure of the rest being attributed to faulty or damaged buds. Rebudding the failures was successful. All withstood the winter successfully. *Vine Breeding Institute.* 1. Selection and breeding of wine grapes. 2. Selection for resistance to *Plasmopara viticola*. 3. Breeding table grapes. *Botanical Institute and Vine Propagation Department.* 1. Wine ferments. Wine diseases. Small fruit wines. 2. Physiological problems of pollination. 3. Effect of oil sprays on growth. 4. Transpiration in the vine. 5. The use of β -indolylacetic acid when grafting was found successful given particular strengths and times of application. 6. Experiments indicate that oil emulsions offer a means whereby vine grafts may be induced to make quicker growth, or to callus more easily. Moreover it appears that not only can the period available for grafting be extended through treatment of the wood in April, but also that frost damage can be checked by the use of oil emulsion which delays the start of growth by 2 to 3 weeks. *Plant Disease Institute.* 1. Substitutes for arsenicals are still being sought. 2. Damage done by sprays to plants and bees. 3. "Reisig" disease in vines. 4. The effect of boron on the vines. 5. Brown rots. 6. Copper in bordeaux mixture. 7. Control of the vine moths, *Clysia ambiguella* and *Polychrosis botrana*. *Institute for Biochemistry and the Chemistry of Wine.* 1. Wine analyses. *Vegetable and Fruit Products Institute.* Fruit juice manufacture, especially clarification, canning, mould formation in jams. *Silk Department.* Vegetative propagation of mulberry cuttings—(a) hardwood, very little success, (b) soft wood, considerable success 71.6%; layers—success 58% when stems bent over and buried in soil and peat; grafts—success not so great as in previous year owing to poorness of material. Propagation by seed—good humus soil found necessary. Leaf quality tests with silkworm larvae proved successful. Comparison of silkworm breeding methods.

698. **GEORGIA.** 634/5
Fifteenth Annual Report of Georgia Experiment Station for 1937-38, pp. 99.

This "golden anniversary" report contains an account of the growth of the Experiment Station as well as brief reports of the progress of particular experiments. Among horticultural work the following may be noted:—Minor elements in pepper nutrition. Peach sprays. Peach root systems. Prevention of soil erosion in peach orchards. Use of growth-promoting substances on *Vitis rotundifolia* cuttings.

699. **GOLD COAST (WRIGHT, J.).** 633.74
First Annual Report (1937-38) of the Cocoa Research Station, Tafo, 1938, being *Bull. Gold Coast Dep. Agric.* 36, pp. 36, 1s.

The immediate general problems to be examined by this newly formed research station are (a) the maintenance in fertility and the improvement of existing farms; (b) the reclamation of derelict cacao areas; (c) methods to be adopted in planting new areas. In these problems the fundamental factor is the conservation of atmospheric humidity and soil moisture. The question of shade is discussed and the conclusion reached that shade is not necessary provided the soil is deep and fertile, but that Gold Coast cacao being usually grown on poor shallow soils and therefore having most of its roots near the surface would benefit by the use of shade

trees for a number of reasons which are given. The preliminary lay-out of the station is described. The report concludes with a draft programme of considerable length setting out the work on which it is hoped to start in the near future. Appendixes tabulate a number of records already made. There are some interesting photographs.

700. IMPERIAL ECONOMIC COMMITTEE, LOND. 31 : 633.6+633.72+633.73 +
633.74+633.83+633.71+633.912

Plantation crops.

H.M. Stationery Office, Kingsway, London, W.C.2, 1938, pp. 114, 2s. 6d.

This is a compilation of figures of world production of and trade in sugar, tea, coffee, cocoa, spices, tobacco and rubber over the period 1930 to 1937 inclusive, with special reference to the part played by the countries of the British Commonwealth of Nations.

701. IMPERIAL ECONOMIC COMMITTEE, LOND. 658 : 634.1/8+634.85
Fruit. A summary of figures of production and trade relating to apples, pears, bananas, citrus fruit, grapes, wine, raisins and currants, canned fruit.*
H.M. Stationery Office, Kingsway, London, W.C.2, 1938, pp. 88, 2s. 6d.

702. INDIA, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH. 634+664.85
Annual Report for 1937-38, 1938, pp. S.1.

The following notes are taken from the horticultural section of this report. *Citrus*. Shield budding of orange (*C. sinensis* var.) on Guntur sour stock has given a higher percentage of success when the wood at the back of the shield was not removed. The break of buds of sweet orange inserted on a Guntur sour stock was accelerated by cutting back the stock at the time of budding, but postponing the heading of the stock for a month after budding resulted in plants which could be transplanted to permanent positions much earlier. A study of root systems of 8 rootstock varieties has revealed the remarkable depth to which roots of some varieties penetrate and the severe root pruning to which such varieties must be subject on transplantation. *Mango*. A large scale experiment showed that the grading of mango seed for size of fruit or stone was no indication of germination percentage and vigour of seedlings. Inarching with rootstocks only 3 months old was found feasible. Exposure of mango seedling roots at transplantation was not harmful. Inarched mango grafts planted out immediately on separation from the parent tree started growth earlier than those kept under shade for some time after detachment, as is the usual practice. *Cold storage*. Fully ripe Nagpur and Malta oranges can be kept without wastage for 3 and 4 months respectively at 40° F. Wrapping Alphonso mango with tissue paper adversely affects ripening power after storage. A suitable crate for packing Alphonso mangoes for cold store is 24" × 12" × 12" and holds 100 fruit. Only a light wadding should be used as packing material to support the fruit. The fruit of Pyree mango—at B stage of maturity—can be kept for 7 weeks at 45° F. without spoilage. Italian seed potatoes stored at 35° F. for 12 months lost none of their germinating power. Several horticultural research stations supply information of their investigations in progress but results are not indicated.

703. INDIAN TEA ASSOCIATION. 633.72
Annual Report of the Scientific Department for 1937, 1938, Calcutta,
pp. 48.

Notes are made on experimental work, brief separate accounts of which are given in appendixes. These deal with data amassed and with tasters' reports on trials made to test the effect of various factors, e.g. plucking and pruning practice, on the quality of tea produced. Appendix C gives the results of observations on the flowering of the tea bush, D of bulk organic manures and their value.

* For previous number see H.A., 8 : 926.

704. INSTITUTE OF PLANT PROTECTION, LENINGRAD. 632.3/9
Summary of the scientific research work of the Institute of Plant Protection for the year 1936. III. Viruses and bacterioses, biological method, chemical method and mechanization.
 Govt. Publishers of State and Collective Farm Literature, Selkhozgiz, Leningrad, 1938, pp. 111.

The report falls into 5 sections:—VIII. Virus and bacterial diseases. IX. Biological control of pests and diseases of horticultural and plantation crops. X. Biological control with the aid of fungi and bacteria. XI. Chemical methods of pests and disease control. XII. Mechanization of methods of plant protection. Each section contains a number of articles written by different authors.

705. IOWA (BUCHANAN, R. E., Director). 634/5
Report on agricultural research for the year ending June 30, 1938. Part I. Project reports, publications, staff, financial statement.
Annu. Rep. Ia agric. Exp. Sta. for fiscal year ending 30 June, 1938, pp. 262.

Brief notes are given on the progress and results achieved by workers in the different projects. Among these are the following:—Breeding and selection of wilt-resistant water melons. Onion diseases. Cedar apple rust, apple scab, root necrosis. Nursery diseases. Onion insects. Codling moth control. Indexing of paeony and iris varieties. Stock-scion effects in apple. Production of dwarfing stocks for apples. Varietal storage temperatures. Breeding peaches for hardiness. Respiration in the Jonathan apple. Soil treatment for strawberries. Vegetative propagation as associated with juvenile forms and adventitious buds in apples. Breeding roses. Growth-promoting substances (hormodin), applied at different concentrations and in different ways. Asparagus cutting. Effect of variety and fertilizer on sweet potato storage capacity. Sweet potato breeding and propagation. Improvement of musk melons.

706. JERSEY (PRÉSIDENT DU COMITE D'AGRICULTURE). 634/5
Rapports : pour l'année 1936 and Rapports pour l'année 1937. (Reports for the years 1936 and 1937), 1937 and 1938, pp. 73 and 45.

The reports, in English, deal with the following subjects:—The work of the Howard Davis Experimental Farm, Trinité, Jersey, the incidence and control of disease in tomatoes and potatoes, practical notes on the health of fruit and vegetable crops during each year and the work of the analytical chemist. Finally meteorological notes are given.

707. KAPUSKASING. 634/5 : 551.556.3
Experimental Station, Kapuskasing, Ontario, Results of experiments 1931-36, 1938, pp. 30.

Horticulture is precarious in these cold regions. Apples which bore crops in the 5 years of the report were the Columbia, Osman, Dolgo and Mecca crabs. Of plums Mammoth, Compass and Sapa produced fruit. Sand cherries died out following extreme cold, but other seedlings from Morden are now being tried. Small fruit varieties which have done satisfactorily include Latham, Newman, Viking and Herbert raspberries, Senator Dunlap strawberry, Keepsake and Downing gooseberries, Saunders black currant, Red Grape red currant, White Cherry and White Grape white currants. Vegetables which have done well are also listed.

708. KENTVILLE. 634/5
Dominion Experimental Station, Kentville, N.S., Results of experiments 1931-36 inclusive, 1938, pp. 32.

Horticulture, including fruit growing, is the chief interest of this report, and of fruit trees apples are the most important. Brief descriptions of experimental work are given on the following subjects:—*Fertilizers*—different amounts, different combinations, use of same fertilizers with different cultural systems. *Rootstock trials* since 1930 with the Malling types show that under Nova Scotian conditions XII is the most vigorous and is followed by XIII, XVI, I and V,

while II is semi-dwarfing and XI very dwarfing. XIII and I have so far been most productive. It is also noted that trees on French crab planted at the same time are as vigorous as any of the above and were in fruiting as early. *Ringing*. To induce fruiting the method found to be most satisfactory in trials is that known as the double spiral in which a band of bark $\frac{3}{8}$ in. wide is removed in a spiral twice round the trunk, starting about 1½ ft. from the ground. The opening is filled with grafting wax. *Varieties of tree fruits*. Notes are given on the merits of different native and introduced varieties of apple, pear, plum, cherry and the ordinary small fruits. *Breeding investigations*. Work is in progress with apples, cherries and blueberries. *Storage*. Investigations are in progress on optimum temperatures for apples, gas storage for apples and pears. *Dehydration of apples*. *Canning*. *Vegetables*. Work on vegetables has mainly been directed to the discovery of the best varieties for Nova Scotian conditions. Notes are given on satisfactory varieties. *Ornamentals*. Considerable attention is paid to selection of desirable shrubs and perennial and annual flowers.

709. LAUSANNE (FAES, H., Director). 634.8+634.1/7
Rapport annuel de la station fédérale d'essais viticoles à Lausanne et Domaine de Pully 1937. (Annual report of the Swiss federal research station for viticulture and fruit growing at Lausanne for 1937), being reprinted from *Annu. agric. suisse*, 1939, pp. 19.

This is a short account of activities at Lausanne and Pully during 1937. Among processes discussed waxing fruits for purposes of preservation is under examination. The results of this are good provided the fruit is very carefully picked over before waxing. Investigations have now shown that only the most sheltered southern parts of Switzerland are suitable for the cultivation of the castor oil plant. The normal investigations on vines, including direct producers, wine making and wine faults are noted. Attempts to discover fruit varieties suitable for growth in mountain districts continue.

710. RUBBER RESEARCH INSTITUTE, MALAYA. 633.912
Annual Report for 1936, 1937, pp. 158, \$1.
Annual Report for 1937, 1938, pp. 211, \$1.

These reports describe the annual work of the Rubber Research Institute of Malaya. As usual they contain brief notes on a large number of experiments covering a wide field. The more important of these are dealt with in detail in the quarterly journal of the Institute and are abstracted in *Horticultural Abstracts* as they appear.

711. MORDEN. 551.566.3 : 634/5 : 581.084.2
Dominion Experimental Station, Morden, Manitoba, Results of experiments 1931-7, 1938, pp. 63.

This report on 7 years' work from Morden is concerned mainly with horticulture and contains details of varieties of top and small fruits which are likely from indications given in trials at Morden to prove successful under the very vigorous prairie conditions of Manitoba. Propagation experiments are second only in importance at Morden to those on controlled breeding. Details of recommended technique are given with regard to obtaining own rooted trees, plate budding, season of budding, rootstock pruning, taking of cuttings and their storage, use of wax for inserted buds. Notes are given on rootstocks, double working, pruning, wound dressing, spraying, various orchard pests. Varietal and pruning hints are given with regard to the small fruits, which incidentally do not have too happy a time under Morden conditions. Lists of, and cultural notes for suitable vegetables are given. Trials are recorded on the use of mulch paper, cultivation versus no-cultivation for vegetables, fertilizers for vegetables, vegetable breeding, the use of windolite instead of glass. A considerable section of the report (27 pages) is devoted to work on ornamentals.

712. NEW YORK. 634/5

Proceedings of the 84th Annual Meeting of the New York State Horticultural Society, 1939, Rochester N.Y. and Kingston, 1939, pp. 423.

This short volume contains the papers and discussion thereon given during the 84th annual meeting of the Society, as well as a number of questions sent in to the secretary and the answers given. Immediate economic problems of particular interest to the members of the society rather than scientific problems of more general interest are the subject of the papers.

713. NIGERIA. 634.6+634.774

Annual Report of the Department of Agriculture for 1937, 1939, pp. 38, 3s. 6d. (issued as *Sessional Paper 1 of 1937*).

Mention is made of the imminent establishment of an oil palm research station in Nigeria. Experiments to secure better germination of oil palm seeds are still in progress with varying results. The work in fruit juice extraction and export is proceeding satisfactorily with citrus. Pineapple pulp seems more commercially promising than pineapple juice. The export of fresh citrus fruit is unlikely to be profitable at present.

714. NORTH CAROLINA. 634/5

Sixtieth Annual Report of the North Carolina Agricultural Experiment Station for the fiscal year ending June 30, 1937. Progress Report for the year ending December 1, 1937, 1938, pp. 86.

The sections of particular interest to horticulturists are as follows:—Tobacco investigations; cotton improvement; fruit and nut investigations including studies of peach fertilizers, root development and bacteriosis, apple pruning, pecan breeding, dewberry breeding and manuring, raspberry manuring and strawberry spacing, soil and rotation; truck crops; floriculture; peanuts.

715. SCHWEIZER, J. (Proefstation voor Rubber, Koffie en Tabak). 633.71

Jaarverslag Tabak over Juli 1936 T/M June 1937 and Jaarverslag Tabak over Juli 1937 T/M June 1938. (Annual Reports on tobacco of the Research Station for Rubber, Coffee and Tobacco, Dutch East Indies, for the periods July, 1936, to June, 1937, and July, 1937, to June, 1938), being *Meded.* 57 and 62, 1937 and 1938, pp. 46 and 59.

These annual reports deal with the activities of the tobacco section of the rubber, coffee and tobacco research station, Java. Experimental work was carried out on selection, manuring, pests and diseases and curing.

716. PROEFSTATION VOOR VORSTENLANDSCHE TABAK. 633.71

Jaarverslag 1937-1938. (Annual Report of the Research Station for Vorstenland Tobacco for 1937-8), being *Meded.* 87, 1939, pp. 73.

The year's tobacco research at the Klaten research station, Java is here described.

717. QUEENSLAND ACCLIMATISATION SOCIETY. 634/5

Seventy-second Report of the Queensland Acclimatisation Society, April, 1937-March, 1938, Brisbane, pp. 12.

This report gives brief details of the growth of the following plants in the orchards of the society:—Avocado, citrus, custard apple, pecans, macadamias, walnuts, lychees, mangosteens, olives, mangoes, papaws, strawberries, dates, soya bean, sweet potatoes, fodder cane, *Crotalaria gorensis*, pineapples.

718. SOUTH AFRICA, UNION OF. 634.1/8
Annual Report of the Secretary for Agriculture and Forestry for the year ended 31 August, 1938.
Fmg S. Afr., 1938, 13 : 459-592.

The report consists of a review of the agricultural industry of the Union with reports by the heads of the various agricultural services and of the Stellenbosch-Elensburg College of Agriculture. Some of the horticultural investigations in progress or completed are briefly mentioned. A physiological trouble of arrested development known as greening, occurring in the Eastern Transvaal and unknown in other citrus countries, has been traced to a calcium and manganese deficiency of the soil. Experiments to decide the contentious question as to the best time of year to apply kraal manure to citrus trees have not so far produced any marked differences. The preliminary work on the cross-transfer of fertilizers in citrus trees has produced results justifying an extension of the work. Manurial trials are in progress with all the commercial fruits. The effect of superphosphate, lime and gypsum sprays on the quality of citrus is under investigation. Further experiments have not contradicted the theory that yellow branch disease in the Western Transvaal may be due to chromium toxicity. Various rootstock and root growth investigations are briefly noted as are a number of irrigation, selection and breeding investigations.

719. SOUTH AUSTRALIA. 634.1/8
Report of Minister of Agriculture of South Australia for the year ended 30 June, 1938, Adelaide, pp. 65.

The report deals largely with figures, which, so far as horticulture is concerned, refer to production of grapes (a) for wine, (b) for drying, and production of fruit, apples heading the list with 1.3 million bushels, followed by oranges 0.8, apricots 0.5, pears 0.3, plums, etc. 0.2, peaches 0.2, lemons 0.05 million bushels. The chief horticulturist's report deals mainly with inspection of fruit, interstate imports and exports and general fruit exports, as well as imports from overseas examined under the Federal Quarantine Act. He also gives short notes on work at the various experimental centres. The Roseworthy Agricultural College annual report is included and in it the principal vine varieties grown are listed.

720. SOUTHERN RHODESIA (BRAIN, C. K.). 633.71
Report of the Tobacco Research Board for 1937.
Bull. Minist. Agric. S. Rhodesia 1072, pp. 47, reprinted from *Rhod. agric. J.*, 1938, 35 : 350-78, 424-42.

A condensed report of the experimental work of the Tobacco Research Board, Rhodesia. Manurial treatments and pest and disease control are the main subjects of investigation.

721. ST. VINCENT, B.W.I. 633.681
Report of the Agricultural Department for 1937, 1938, pp. 43, 6d.

Some experiments, among others, were carried out on the manuring of arrowroot. The average per acre increase in yield following an application of 300 lb. sulphate of ammonia applied in one dose when the plants were 3 months old was 5,146 lb. of rhizomes or 32%. Pen manure at 10 tons per acre, applied when the previous crop was dug, produced an increase of 23% ; at 20 tons per acre the increase was nearly 40%. From these figures it is probable that still larger quantities of pen manure would have produced proportionately increased yields. It is noted that the pen manure was of poor quality. Conclusions between the respective economic values of the two manures should not be drawn until the residual effects of the pen manure are known. In trials with other nutrient elements superphosphates, 84 lb. and 168 lb. per acre in each case, gave an increased yield of 16% in one district with insignificant and definitely depressed yields in two other localities. Sulphate of potash, 45 lb. and 90 lb. per acre, in one district produced significantly increased yields, the double dressing giving almost twice as much as the single,

but in others the increases were insignificant and increasing the amounts had no effect. A single artificial defoliation reduced yield of rhizome, up to 38%, and also starch content. This observation was made in connexion with the damage caused by the leaf roller, *Calpodes ethlius*. The first was effectively controlled, as also was the cotton worm *Alabama argillacea*, by a colloidal lead arsenate, prepared by Lunevale Products, England, at a total cost of \$1.50 per acre including labour and materials.

722. VINELAND, ONT.

634/5

Report of the Horticultural Experiment Station, Vineland, for the year ending March 31st, 1938, pp. 12, being reprinted from *Rep. Minist. Agric. Prov. Ontario*.

Among research projects, on the progress of which brief reports are made, the following may be noted:—*Nutrition of peach trees*. Pot experiments indicate that the peach utilizes a low ratio of N to K and that P is necessary only in small amounts. *Root rot in strawberries*. The effect of producing clean rooted plants by preliminary growth in steam sterilized soil is being investigated. *East Malling apple stocks*. After 8 years' trials worked with R.I. Greening XVI produces larger and more productive trees than French Crab stocks. II produces slightly dwarfed trees but trees rather more productive than those on French Crab except in the variety Melba. Malling I has not been very satisfactory possibly owing to the fact that Vineland soils are low in available K. Trees on IX are very dwarfing but are still leading as regards total crop. *Cherry stocks*. At the end of the fourth year trees on Mazzard would appear to be about to overtake those on Mahaleb which were larger when planted and have remained so since. It would appear that a very wet spring affects Mahaleb roots more severely than those of Mazzard. *Pruning trees at planting*. Trials indicate that either the laterals should be left full length or they should be cut to a one or two bud stub, preferably the latter. *Grape pruning and soil fertilization*. *Asparagus strain test*. One season's yield indicates that the plants from selected high yielders may outyield some of the commercial seedlings by nearly 100%. *Fruit breeding*. Of apples Baldwin, Blenheim, Gravenstein and R. I. Greening, being triploids, should not be used for breeding. McIntosh shows promise as a parent. Of pears tried only Bartlett, Clapps and Clairgeau have given promising seedlings so far. Plums have on the whole given poor seedlings. Notes are also given on sweet cherry breeding and there is a tabulated summary of peach breeding work from 1911-1937. Breeding work is also in progress on tomatoes, sweet corn and rhubarb.

723. WASHINGTON.

634/5

Forty-eighth annual Report for the fiscal year ended 30 June, 1938.

Bull. Wash. agric. Exp. Sta. 368, 1938, pp. 100.

The important work done in 1937/8 by the Washington station at Pullman is here noted briefly. A list of 38 bulletins shows where more detailed information is available. The following divisions or sections are of particular interest to horticulturists:—*Chemistry*—insecticides, spray residues, fruit by-products; *Entomology*; *Horticulture*—cover crops, fruit maturity, apple propagation, winter injury, set of fruit, spray injury, strawberry breeding, manuring, raspberry breeding, irrigation, bitter pit, truck crops, fruit storage; *Plant pathology*—apple and pear fruit rots; *Irrigation*—orchard soil moisture, response of fruit trees to irrigation, processing of irrigated fruit and vegetables; *Cranberry—blueberry laboratory*; *Soil and water conservation experiments*; *U.S. Fruit and Vegetable Products Laboratory*—utilization of apple and soft fruit products, vegetable products.

724. WASHINGTON.

634/5

Proceedings of the 34th Annual Meeting of the Washington State Horticultural Association 1938, Yakima, Wash., 1939, pp. 194.

Subjects discussed at the annual meeting included the following:—Mite control. Apple pruning. Codling control including use of cryolite and arsenicals. Apricot growing. Peach growing. Nutritional value of apples. Response to fertilizers and minor element deficiencies. Canning free-stone peaches. Tolerance of orchard cover crops to arsenical toxicity in the soil.

725.

WYE.

63 : 058

The Journal of the South-Eastern Agricultural College, Wye, Kent, 1939, No. 43, pp. 72, 2s. 6d.

This January edition of the Journal contains as usual the brief reports of the various departments of the college for the past year, including lists of publications by members of the staff.

726.

The annual reports mentioned below have also been examined. Much of the research referred to in them has been dealt with more fully elsewhere and abstracted in *Horticultural Abstracts*.

Divisional Reps Dep. Agric. Brit. Guiana for 1937, 1939, pp. 101.

Rep. Dep. Agric. Brit. Honduras for 1937, 1938, pp. 46.

Annu. Rep. vet. agric. Dep. British Somaliland for 1938 (stencilled), 1939, pp. 26.

Rep. agric. Stations Dep. Agric. Burma for year ended 31 March, 1938, 1938, pp. 240, Rs. 6 = 9s.

Annu. Rep. Dep. Agric. Cyprus for 1937, 1938, pp. 58, 3s.

Annu. Rep. Delaware agric. Exp. Sta. for fiscal year ending 30 June, 1938, being *Bull.* 214, pp. 45.

Annu. Bull. Divisional Reports Dep. Agric. Fiji, 1937, 1938, pp. 95, 2s. 6d.

Rep. Dep. Agric. Colony of The Gambia for the period ending 31 May, 1938, 1938, pp. 39, 2s.

Annu. Rep. Dep. Agric. Jamaica for the year ended 31 December, 1937, 1938, pp. 83.

Annu. Rep. Dep. Agric. Kenya Colony and Protectorate, 1937, Vol. 1, 1939, pp. 142, S2.50.

Annu. Rep. Dep. Agric. Colony of Mauritius for 1937, 1939, pp. 73, Rs. 1.

Agric. Exp. Sta. Rep. Michigan. Two years ended 30 June, 1938, 1938, pp. 48.

Forty-fourth annu. Rep. Minnesota agric. Exp. Sta. 1 July, 1936-30 June, 1937, ? 1938, pp. 91.

Annu. Rep. Agric. Nyasaland Protectorate, 1937, 1938, pp. 68, 2s. 6d.

Fifty-first annu. Rep. Pennsylvania agric. Exp. Sta. for fiscal year ended 30 June, 1938, being *Bull.* 367, pp. 68.

Annu. Rep. Dep. Agric. Colony of Seychelles for 1937, 1938, pp. 33.

Annu. Rep. Dep. Agric. Sierra Leone for 1937, 1938, pp. 70.

Annu. Rep. Dep. Agric. & For. Sudan Govt., Part II, for year ended 31 December, 1937, ? 1939, pp. 139.

Annu. Rep. Dep. Agric. Tanganyika Territory, Part II, 1939, pp. 47, S2.50.

Report of Imperial College of Tropical Agriculture, Trinidad, Governing Body and Principal and Accounts for year ended 31 August, 1938, 1939, pp. 39.

Annu. Rep. on Field Experiments on Sugar-Cane in Trinidad for 1938. (TURNER, P. E.) Sugar-Cane Investigation Cttee, Trinidad, 1938, pp. 121.

Annu. Rep. Dep. Agric. Uganda Protectorate for year ended 31 December, 1937, Part I, 1938, pp. 60, 3s.

HORTICULTURAL ABSTRACTS

Complete sets and single numbers will shortly be available.

In answer to enquiries back numbers of Horticultural Abstracts are now being reproduced and should be available for distribution by the end of July.

They will be available, as from the date on which they are received for issue by the Bureau, at revised prices, which will then hold good for all numbers of Horticultural Abstracts.

REVISED PRICES.

Volumes I and II, 15/- a volume of four numbers, single copies 4/-. Concession price to subscribers in the British Commonwealth of Nations 10/- a volume, single copies 2/6.

Volume III and subsequent volumes 25/- a volume, single copies 6/6. Concession price 20/- a volume, single copies 5/-.